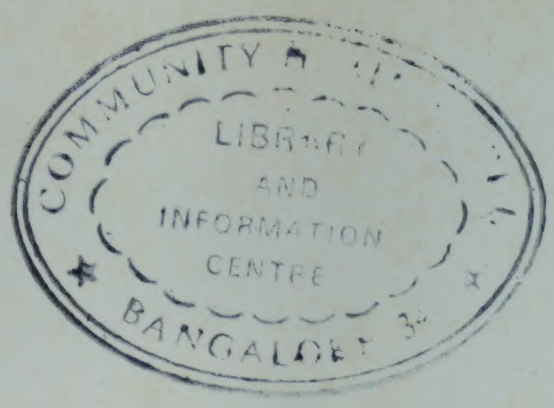
National Symposium and XIII IVACG Meeting

Kathmandu, Nepal
5–10 November 1989

International Vitamin A Consultative Group (IVACG)®



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and

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The purpose of the International Vitamin A Consultative Group (IVACG)® is to guide international activities aimed at reducing vitamin A deficiency in the world. The group offers consultation and guidance to various operating and donor agencies that are seeking to reduce vitamin A deficiency and its accompanying blindness. As part of this service, IVACG has prepared guidelines and recommendations for

- Assessing the regional distribution and magnitude of vitamin A deficiency
- Developing intervention strategies and methodologies to control vitamin A deficiency
- Evaluating the effectiveness of implemented programs on a continuing basis so that the evaluation of the effectiveness of intervention techniques is a continuing and dynamic procedure
- Research needed to support the assessment, intervention, and evaluation of programs

These guidelines and recommendations are available through IVACG's publications program. A list of publications available from IVACG, along with ordering information, is given on the inside back cover of this meeting summary.

The publication of this meeting summary is made possible through a cooperative agreement between the Office of Nutrition, Bureau for Science and Technology, Agency for International Development of the United States of America, and The Nutrition Foundation, Inc., Washington, D.C.

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Introduction

The International Vitamin A Consultative Group (IVACG) is an organization "dedicated to reducing the prevalence of vitamin A deficiency worldwide." Established in 1975 with support from the US Agency for International Development (USAID), IVACG sponsors international meetings, offers technical guidance, and convenes task forces to analyze issues related to the etiology, treatment, and prevention of vitamin A deficiency. IVACG activities involve scientists, programmers, and policy makers throughout the world who are working to prevent this nutritional deficiency.

The National Symposium and XIII IVACG Meeting was held in Kathmandu from 5-10 November 1989. The meeting, co-hosted by Nepal Netra Jyoti Sangh and IVACG, was attended by over 270 nutritionists, physicians, and public health workers from 33 countries who share a common goal: the prevention and control of vitamin A deficiency and its morbid sequelae. The National Symposium on Vitamin A Deficiency in Nepal had three basic objectives: to (a) compile what is known about vitamin A deficiency in Nepal, (b) summarize what is being done at present, and (c) explore ways to prevent this nutritional disease in the future. The theme of the XIII IVACG Meeting was an update on studies relating vitamin A nutriture to childhood morbidity and mortality. The meeting gave additional emphasis to newer techniques for assessing marginal or subclinical vitamin A deficiency.

In addition to pertinent reviews and oral presentation of research findings, this was the first IVACG meeting to include poster sessions. These proved to be a very successful addition to the oral platform presentations. This informal opportunity allowed the presenter to discuss details of the study to whatever degree the questioner desired. In order for there to be opportunity on the formal agenda for all organizations to report on their programs, time allotted was strictly limited for each. Presenters were encouraged to focus their oral talks on major program highlights, yet they had the option of expanding the topic during the subsequent poster session. This allowed the agenda to contain more reports than in previous meetings from agencies, NGO's, and countries within the allotted timeframe.

While it is not possible to totally capture the excitement and encouragement experienced by those who attended the meeting, this report attempts to convey much of the factual material that was presented, and some of the discussion that ensued. The IVACG secretariat is indebted to Dr. Donald McLaren for serving as meeting rapporteur and to Dr. Keith P. West, Jr. for providing the summary of the National Symposium session on Vitamin A Deficiency and Prevention in Nepal: Building a National Strategy.

A Note About Symbols

Abstracts of presentations that were received by the secretariat are included in this meeting summary. Several speakers also provided longer manuscripts of their talks which are not included in this summary, but are on file at the secretariat office. A copy will be sent to those who request it. The symbols following a presenter's name indicate the type of document available:

† indicates abstract received and included in this report

‡ indicates paper received and on file at the secretariat office

NATIONAL SYMPOSIUM

Inauguration by Her Majesty, Queen Aiswarya Rajya Laxmi Shah

Dr. B.D. Chataut, acting as master of ceremonies, welcomed the delegates to the Royal Nepal Academy and introduced the speakers. Messages of welcome and good wishes were presented by those representing interested and involved national and international organizations and institutions. A list of these speakers is shown on the meeting agenda included with this report as Appendix 1. Her Majesty inaugurated the meeting by lighting a candle that appropriately symbolized the dispelling of darkness by the coming of light; the darkness of blindness by the preservation and restoration of sight, the darkness of ignorance by the spread of knowledge.

Overview and Update of the Global Vitamin A Problem

Co-chairperson: Dr. R.P. Pokhrel
Dr. Abraham Horwitz

Global Dimensions of Vitamin A Deficiency: Dr. Demissie Habte

Dr. Habte estimated that about 10 million children under the age of 6 years develop some degree of xerophthalmia each year and that about a million of these go blind, making it the most common cause of blindness in this age group. Most of these children die within one year. Research in Indonesia has suggested that an even more widespread effect of subclinical vitamin A deficiency is associated with increased rates of mortality, possibly through greater susceptibility to infections of the gastrointestinal and respiratory tracts.

Malnutrition predisposes to infection and infection contributes to malnutrition, resulting in a vicious cycle. Where should this be interrupted? In children under 5 years about 1 billion episodes of diarrhea occur annually, and half again as many acute respiratory attacks. There are 5 "bullets" that threaten the life of the young child: diarrhea, measles, pneumonia, malnutrition and trauma. It is clearly impossible to deliver a package against these to all children. However, a partial package or partial coverage is ineffective. Removing one "bullet" leaves the child open to all the others. Ensuring adequate nutritional status could be likened to

providing a "bullet-proof vest." Whether or not vitamin A might prove to have this protective function would be addressed at this meeting.

New Aspects of the Biology of Vitamin A: Dr. James A. Olson ‡

Both vitamin A and the carotenoid plant pigments have biological actions of great current interest in physiology and medicine. Recent reports that even in the absence of clinical signs of vitamin A deficiency supplementation significantly reduces mortality of young children have led to renewed efforts to more precisely detect the marginal deficiency state in the community. Additional field trials under varying ecologic conditions are underway to further investigate this reported effect having great public health potential.

About 600 carotenoids have been identified in nature. Of these, about 50 have provitamin A activity although only 3 or 4 are present in customary diets to any extent. Some of these, including those that are non-provitamin, may have important antioxidant effects in relation to free radicals and singlet oxygen in various disease states. The varied functions of a number of retinoid-binding proteins are being intensively investigated as are the mechanisms controlling the release of retinol from the liver.

The function of vitamin A in vision is being elucidated in ever increasing detail. Its role in cellular differentiation appears to involve the transport of retinol and retinoic acid to the nucleus by cellular retinoid-binding proteins. Here the latter and possibly the former react with specific nuclear receptors, influencing such fundamental processes as DNA transcription.

The pharmaceutical industry has synthesized about 2500 retinoids in the search for safer and more effective compounds to treat and study various skin disorders including cancer and certain epithelial precancerous states. Recent work suggests that the function of vitamin A in the immune response is related mainly to the activity of T-helper cells, with Type 2 antigens involved.

Toxicity of vitamin A and retinoids may be acute, chronic or teratogenic. Birth defects have been reported in the offspring of women receiving large doses of 13-cis retinoic acid for the treatment of acne. A dose of 10,000 IU (3mg or 10.5 moles of retinol), 3-5 times the Recommended Daily Intake (RDI) for most

countries, has been considered by several responsible groups to be safe for women in early pregnancy.

Newer Aspects of Assessment of Vitamin A Nutrition: Dr. Alfred Sommer

Prevalence and incidence data from 4 Asian countries suggested that there were about 5 million new cases of xerophthalmia (all stages) per year with 250,000 resulting in blindness. These figures could be doubled as a worldwide estimate. In Indonesia about 50% of preschool children had serum retinol < 20μg/dl; 3% had XN, X1B or both; and about 30% had abnormal conjunctival impression cytology (CIC). Thus, as judged by CIC, there are about 100 million preschool children with subclinical vitamin A deficiency of probable significance to morbidity and mortality. There is no "gold standard" for assessing vitamin A status. Consequently, statements concerning sensitivity and specificity are not realistic. The various tests do, however, form a continuum and can serve as indices of population status. All the clinical eye signs are difficult to interpret. In particular, WHO and IVACG recommend repeatedly that X1A (conjunctival xerosis) should not be used as an indicator in field studies because of poor reproducibility. X1B (Bitot's spots) is a valid indicator in children less than 6 years old, but cyclical changes independent of vitamin A status and persistent metaplasia mean X1B should not be used for assessing an intervention.

Intervention Strategies and Long-term Solutions in the Prevention and Control of Vitamin A Deficiency: Dr. Barbara A. Underwood ‡

Vitamin A deficiency as a public health problem occurs within an ambiance of threefold deprivation: social, economic, and ecologic. The available interventions - - supplementation, fortification, nutrition and health education, horticultural and agricultural strategies, public health interventions (e.g., immunization, breast feeding promotion, diarrhea control, and weight monitoring), and socio-economic interventions - - were each reviewed in the context of this complex ambiance.

It can be concluded that scientific questions no longer constitute a barrier to the control of the problem. It is now a matter of political will, proper allocation of resources, and further identification of sustainable approaches to address the underlying causes. Future programs for marginally deficient children need to be

more community oriented. Sustainable long-term solutions are possible only when they are considered in relation to the community's overall needs for social, economic, and ecologic development.

* * * * *

In the subsequent audience discussion, some of the salient points made by the speakers were developed further.

- It was suggested that the relationship 1 μg retinol = 1.0 μg RE (retinol equivalent) = 6 μg beta-carotene = 12 μg other provitamin carotenoids may understate the potency of the carotenoids by approximately 50%, but research was needed in this area.

- The view was expressed that some countries using megadose universal vitamin A distribution for many years had become dependent on this supplementation despite the fact that due to poor implementation the supplements had no measurable impact.

- The Caruaru experience in Brazil was cited as a successful example of municipality involvement to deliver the high-dose supplement repeatedly with broad coverage. Men, as well as women, from the political, business, and professional communities participated in the Caruaru program.

- In Guatemala following interruption of the sugar-fortification program there was evidence of resurgence of vitamin A deficiency, probably related to neglect of the educational approach to elicit behavioral change. Where poverty is great, income generating projects are vital.

Vitamin A Deficiency and Prevention in Nepal: Building the National Strategy

Session 1 The Public Health Importance of Vitamin A Deficiency in Nepal

The meeting provided clear evidence that vitamin A deficiency is a major public health problem throughout Nepal. As early as 1965-1966, data from a national health survey brought attention to low dietary intakes of vitamin A in the eastern and far-western Tarai. A study from Bir Hospital in the mid-sixties ascribed 50% of observed childhood blindness to vitamin A deficiency (2,3). However, it was not until 1981 that two separate, ophthalmologic surveys, by the WHO Prevention of Blindness Programme (4,5,6) and the Institute of Medicine at Tribhuvan University (2,7), reported the national prevalence of xerophthalmia (Bitot's spot, X1B) to be 0.6% (6) and 1.3% (2), respectively, among preschool children. Both surveys were consistent in demonstrating that xerophthalmia was a public health problem (exceeding minimum criteria set by WHO) and that the East-central Tarai harbored the highest risk of deficiency (2.8% and 4.6%, respectively).

Now, 8 years later, vitamin A deficiency appears to be no less - and perhaps more - of a problem. In a consecutive series of 4601 children presenting to the Lahan Eye Hospital outpatient clinic from 1986-1988, 683 (15%) had xerophthalmia of whom 295 (43%) had corneal disease (X2 or X3). Half of all xerophthalmic cases were seen during the peak months of May through August (8). Recent cross-sectional surveys further document the problem among preschool children in the Eastern and Central Tarai. Preliminary data from ongoing surveys being carried out in association with large research projects in Sarlahi (9), Bara, and Parsa (10) districts suggest 2-3% of preschool children have active xerophthalmia. These rates are fully consistent with estimates from the two national surveys nearly a decade ago.

Mass screening surveys for xerophthalmia were carried out during a vitamin A capsule (200,000 IU) distribution campaign in May-June 1988, in conjunction with the Seva Foundation eye care service outreach program in three West-central Tarai districts (Rupandehi, Nawalparasi, and Kapilvastu). More than 17,000 children were examined by primary eye care volunteers. Xerophthalmia rates were consistent across the three districts, ranging from 1.5-1.9% (11).

Community-based surveys by the UK Save the Children Fund in the Western Hill District of Baglung in 1979 and 1986 (N=1500 and 1000 children, respectively) reported prevalence rates of active xerophthalmia of 1-2% (12). In 1987, a UK SCF survey of over 1100 children living within an active health program catchment area in Surkhet found 1% of children with active xerophthalmia. Clinic-based rates during 1985-1987 from this same area were several-fold higher (13). Most recently, a July-August 1989 survey in Jumla (N=3653) found 13% of children under 5 years of age to have active xerophthalmia (14). These more recent, local surveys suggest that vitamin A deficiency is also a serious problem among children in the Hills and Mountains of Nepal. This is further supported by dietary studies showing low vitamin A intakes among children as well as women of child-bearing age in the Hills and Mountains.

However, a reported strong correlation between caloric and vitamin A intake suggests that some staples, particularly yellow maize, may contribute significant amounts of vitamin A to the diet in some Hill areas (15).

Session 2 Vitamin A Intervention Strategies and Programs

With Vitamin A deficiency evident, attention at the meeting turned to its control. A coordinated attempt to improve vitamin A intake can be indirectly traced to the first National Nutrition Strategy ("Pokhara Declaration I") formulated in 1978. Broad guidelines were ratified to make food production and distribution more equitable, increase purchasing power among the poor through income generation, and promote nutrition and health as a vital part of national development. This led to the creation of the National Nutrition Policy Coordination Committee as well as Nutrition Sections within the Ministries of Health (MOH), Agriculture (MOA), Education (MOE), and Panchayat and Local Development (MPLD) (16).

Following the "Pokhara Declaration II" in 1986, these broad goals were translated into sectoral plans that are likely to impact on vitamin A deficiency. These include targeted, large-dose vitamin A capsule distribution, promotion of kitchen gardening through seed distribution, and infectious disease control through MOH health posts and their extension workers. The MOE is currently introducing, with assistance from FAO and Tribhuvan University, objective-oriented curricula and teaching materials to support vitamin A education within each sector (17). Vitamin A instruction is being added to teacher training programs, curricula for primary and

secondary schools, adult literacy classes as well as within the Faculty of Humanities and Social Science at the University (16, 17). The MOA is working to improve the vitamin A food supply through subsidized seed, fertilizer, and pesticide distribution; pricing policies to motivate (vegetable and fruit) production; reducing pre- and post-harvest vegetable and fruit losses; and upgraded training of agricultural extension workers in nutrition and horticulture. The MPLD is in a unique position to heighten local perception about vitamin A nutrition by motivating local leaders, teaching through rural credit and women's programs, and other local activities (16).

On a micro-scale, several projects are exploring different, but complimentary, approaches to the control of vitamin A deficiency. Preliminary data from a behavioral study of 466 households in Chitwan suggest there are deep-seated taboos against giving babies colostrum during the first 4 days of life and serving dark green leafy vegetables to children that must be overcome in this area of the Tarai (18). Posters and booklets, suitable for displaying in health posts and other public places, have been produced that emphasize how to recognize xerophthalmia and prevent its occurrence through nutritious food and health measures (19).

A manual on carotene-containing foods in Nepal has been recently published in Nepali by the Central Food Research Laboratory with support from FAO (20). This work represents a major contribution to understanding the vitamin A adequacy of Nepali foods that should assist nutritionists and planners in all sectors in their work to improve the local diet (21).

The planned and systematic introduction of home and school gardens appears to hold promise for preventing vitamin A deficiency, particularly where gardens are not generally grown. A Freedom from Hunger Foundation project in Sinhupalchok District introduced a kitchen garden program in 8 panchayats in 1985 where such gardens were rarely seen. By 1989, over 1500 of the 4200 families in the project area had developed kitchen gardens with seasonal vegetables such as spinach, watercress, cauliflower, cabbage, carrot, onion, tomato, and pumpkin being grown (22). Gardens can be most successful when they meet the combined economic, cultural, and nutritional needs of families (perhaps in that order). This theme was repeated in different ways throughout the week-long meeting.

Large-dose vitamin A capsule distribution (200,000 IU) to children over 1 year of age comprises the first line of defense against vitamin A deficiency in most countries. It is widely recognized as a "short-term" solution that requires supplementing children in the community every 4-6 months to achieve sustained protection. Helen Keller International has integrated "targeted" vitamin A capsule delivery (i.e., children with xerophthalmia, malnutrition, measles, etc.) into a community-based rehabilitation program for the blind in Kavre District (23). In Lumbini Zone, repeat annual screening in two districts where capsules had been distributed the year before revealed rates of 0.4% in one (down from 1.6%) and 1.5% in the other (down from 1.9%) (9). A recent review suggests that consistent capsule coverage of at least 65% of the target population is needed to reduce xerophthalmia rates by 75% or more (24).

Fortification has been explored as an intervention to prevent vitamin A deficiency in Nepal. At the minimum, fortification requires that a "carrier" food be technically fortifiable, centrally processed, widely marketed, and consumed by a large proportion of the target population within a known range of intake. Based on a recent consultancy, among the potentially fortifiable foods considered to date (salt, sugar, flour, etc.), there are none that adequately satisfy these requirements for fortification in Nepal (25,26).

Session 3 Vitamin A Research Agenda in Nepal

The survey research on vitamin A of nearly a decade ago has been extended into a large, public health research program to answer vital questions about effectiveness and cost of vitamin A deficiency control in Nepal (1).

Two major, complimentary field studies have been launched in 1989 by Nepal Netra Jyoti Sangh in collaboration with the Dana Center for Preventive Ophthalmology at Johns Hopkins University and the School of Public Health at the University of Michigan, respectively. Both studies have been approved by ethical review committees in the United States and by the Nepal Medical Research Council.

The first is a double-masked, two-year, controlled, community trial among 30,000 children in 261 contiguous wards (29 panchayats) in Sarlahi District in the East-central Tarai. The trial will determine the impact of supplementing preschool children with 200,000 IU vitamin A every 4 months on child mortality, morbidity, and growth. The design and methods of the trial were described (27), with emphasis placed on maintaining procedural standards and data quality throughout the study (28). Preliminary analyses show the different, supplement groups to be very similar in their antecedent and current risk factors, suggesting that they represent the same underlying population (29). Findings of the study are expected in early 1992.

The second field study is being conducted in the Central and Western Development Regions to ascertain the cost-effectiveness of preventing xerophthalmia and vitamin A deficiency in children below 10 years of age by 3 separate strategies: (a) large-dose vitamin A capsule distribution, (b) primary health care (vitamin A capsule distribution plus deworming, promotion of immunization and oral rehydration, treatment for acute respiratory infection), and (c) nutrition education (all in (b) except vitamin A dosing, plus nutrition education elements). Each strategy will be implemented in 25 sites across 7 districts (N=45,000 children). Although multi-faceted, the primary goal is to identify the most cost-effective health and education approaches to prevent vitamin A deficiency in Nepal (30,31).

Conclusion

It is hoped that these diverse, but complementary, programs and research activities currently underway in Nepal will form the basis for developing a national policy and plan of action to control vitamin A deficiency, as a part of His Majesty's strategy to meet Basic Minimum Needs, by the year 2000 (1).

Acknowledgements

The Local National Planning Committee of the XIII IVACG Meeting gratefully acknowledges the contributions of chairpersons Drs. H.B. Gurung, T.N. Uppreti, M.R. Pandey, R.P. Pokhrel, and Abraham Horwitz whose attention to timeliness and valuable comments during discussions enriched this National Symposium. The kind support of UNICEF/NEPAL in sponsoring the National Symposium and other local activities is recognized. Dr. West served as rapporteur for the Symposium.

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XIII IVACG MEETING

Opening Remarks: Dr. Abraham Horwitz, IVACG Chairman

Dr. Horwitz thanked His Majesty's Government for its support. He also thanked the organizing committee and all those responsible for making the meeting possible. Tribute was paid to Dr. Edouard DeMaeyer who died on December 23, 1988. Besides his many contributions to international nutrition at WHO he helped found IVACG and served as its first chairman from 1974-1981. Until his death he provided his vast experience as a member of the steering committee.

The death of two other distinguished figures in the prevention of xerophthalmia and vitamin A deficiency occurred since the last meeting. Dr. Johanna Ten Doesschate of the Netherlands worked as an ophthalmologist for many years in Indonesia. In 1976 she presented a scheme of xerophthalmia classification derived from her own work and contributions of Dutch ophthalmologists before World War II. This scheme considerably influenced the one adopted by WHO in its first report on xerophthalmia. Dr. Ten Doesschate made frequent contributions to IVACG activities.

Dr. S. G. Srikantia, former Director of the National Institute of Nutrition, Hyderabad, India devoted his professional life to applied research on many nutritional deficiencies. He was a pioneer in the administration of vitamin A to prevent nutritional blindness in his country.

Tribute was also paid to U.S. Congressman Mickey Leland who died in a recent plane crash while visiting a refugee camp. He founded and chaired the House Select Committee on Hunger which gave rise to the U.S. Child Survival Initiative. Special annual allocations support the control of vitamin A deficiency, including IVACG activities.

Opening remarks: Dr. Norge W. Jerome, Director, Office of Nutrition, U.S. Agency for International Development

An account was given of the many activities of this office (one of ten in the Bureau for Science and Technology) in the field of vitamin A deficiency. It is involved in

designing projects and programs, arranging for the competition for their funding, and in managing AID's interests with the eventual contractor/cooperator. The focus of the 23 current activities is on child survival and household food security. The most recent contract was awarded to the International Science and Technology Institute (ISTI) to provide vitamin A technical assistance to USAID missions throughout the world. Many of the reports given during this meeting would be from groups receiving support from the Office of Nutrition.

Session 1 Vitamin A in Morbidity and Mortality in Young Children

Chairman: Dr. Abraham Horwitz

Historical Perspective: Dr. Alfred Sommer

Review of the early literature from the second and third decades of this century showed that both animal and human studies stressed the importance of the lack of fat-soluble vitamin A in relation to poor growth, reduced resistance to infection and early death - even before the eyes were seriously affected. Respiratory, urinary tract and ear infections were especially noted in these early studies. These observations remained largely neglected until recently, with concern focused on the eye.

The study of child survival in Indonesia published in 1983 was originally undertaken to try to understand why certain children became vitamin A deficient. This revealed a linear relationship between the severity of xerophthalmia and mortality rate. The Aceh, Indonesia megadose intervention trial published in 1986 reported at least a 30% reduction in mortality which, on adjustment for intention to treat, rose to effectiveness of 41% and efficacy of 72%. A monosodium glutamate (MSG) fortification trial in Indonesia reported a 47% reduction in mortality.

Hospital-based studies in Africa showed a 50% or more lowering of mortality from measles in those treated with vitamin A. In Indonesia and India, respiratory infections were increased in children with mild xerophthalmia but only in Indonesia was diarrhea increased. It was also shown that the risk of mild xerophthalmia in children with diarrhea and acute respiratory infections was increased twofold in Indonesia.

A concluding note of caution was sounded: "the impact that vitamin A supplementation will have on mortality will depend on a constellation of factors including the prevalence and severity of vitamin A deficiency, the frequency of exposure to pathogenic organisms, the size of the inoculum and its virulence, and the presence and degree of other adverse influences with which the young child must contend."

Current Perspective: Dr. Ranjit Chandra (abstract presented in absentia) † ‡

Several investigators have shown important effects of vitamin A deficiency on immune competence, mostly in laboratory animals and especially rodents. It is generally accepted that there is a slight reduction in thymic size and cell number, but a much greater reduction in response of lymphocytes to mitogens such as phytohemagglutinin (PHA) and concanavalin A. Antibody response is less severely affected. Phagocyte function is largely intact. Reduction in serum thymic hormone activity has been reported in vitamin A deficient rats and humans. Twelve children who had received greater than 20,000 IU vitamin A per day for more than 4 months had clinical and laboratory evidence of overdosage, and lymphocyte response to PHA was reduced. In field studies where 200,000 IU has been administered it is reported that a slight but significant fall in lymphocyte response occurs in 3-5 days, followed soon by a marked increase in response.

Effect of Periodic High Dose on Morbidity and Mortality in Preschool Indian Children: Dr. K. Vijayaraghavan † (A completed field study)

Preliminary analysis of a completed trial from Hyderabad was presented. About 8500 preschool children in each of two groups, experimental (200,000 IU vitamin A twice a year) and control (placebo), were randomized by village. From January 1987 to January 1989 morbidity history for the previous month was collected 4 times each year; growth was measured every six months. Mild xerophthalmia was noted but not treated. Experimental and control groups were comparable at baseline for many variables. Preliminary analysis showed a significantly higher rate of respiratory infection, but not diarrhea, in those with xerophthalmia. Weight for age did not relate to these diseases. The mortality relative risk was 2.27 in those with xerophthalmia but this was not significant. Mortality rates for children in the study areas were lower than the national average, but did not differ significantly

between experimental and control groups. Dosing had no significant effect on respiratory disease and diarrhea, possibly because two doses were inadequate and data collection should have been more frequent (e.g., weekly). Further data analysis is underway to establish the effect of vitamin A on child survival.

Effect on Morbidity of a Continuous Modest Improved Intake of Vitamin A in Indian Children: Dr. Laxmi Rahmathullah † (A completed field study)

This double masked study was carried out by Aravind Eye Hospital with support from Royal Commonwealth Society for the Blind (RCSB), National Eye Institute (NEI), and the Ford Foundation. In a poor area of Tamil Nadu clusters of 50-80 children age 6 months to 5 years were assigned to a community health visitor. Baseline randomization was validated by comparability of subsamples of the two groups for medical data, serum retinol, and dietary assessment. In all, 15,500 children were included. On a weekly schedule one group received approximately 8000 IU vitamin A and 20mg vitamin E in 1ml peanut oil, and the other group received only vitamin E in oil. Mild xerophthalmia was treated and subjects remained under surveillance but the data were analyzed separately. There was a trend toward a reduction in the number of diarrheal episodes but they were of longer and not significant duration in the experimental group. There was no significant difference in respiratory morbidity. There was about 60% reduction in deaths in the experimental group (37) compared with the control group (80). Of the diarrhea associated deaths, 67% occurred among the control group and only 33% among the experimental group.

Session 2 Vitamin A in Morbidity and Mortality of Young Children: Africa

Chairperson: Dr. Florentino Solon

VAST Design and Logistic Issues: The Methodology of the Ghana Vitamin A Supplementation Trial on Childhood Mortality: Dr. David Ross †

In northern Ghana a double-blind, placebo-controlled trial on about 15,000 children age 6-59 months began in late 1988. One group received 3 doses of 200,000 IU vitamin A + vitamin E at 4 month intervals. The second group received vitamin E only as placebo. Follow-up will be every 4 months for two years. Subsamples will be examined for hemoglobin, serum retinol, CIC, and anthropometry. Logistical issues were presented. Data collection is in progress.

Vitamin A Supplementation of Asymptomatic Children: Effects on Morbidity and Mortality in Sudan: Dr. Alawia El Amin †

About 24,000 preschool children in two groups randomly assigned by household are receiving every six months either 200,000 IU vitamin A + vitamin E or vitamin E only. Mild xerophthalmia is identified and these children are excluded from the study after treatment. Baseline data revealed considerable differences between the four study areas, but preliminary analysis at 6 months showed no significant differences between experimental and control groups.

A Controlled Trial of Vitamin A on Mortality in Ethiopia: Dr. Hagos Beyene

Two trials were outlined for which data are not yet available: (1) a hospital-based study of the effect of vitamin A or placebo on morbidity and mortality of children admitted with acute lower respiratory tract infection and (2) a community-based study to be carried out in the high plateau area where endemic vitamin A deficiency has been reported. The effect of vitamin A versus placebo on cause-specific rates of mortality will be studied in children age 26-72 months with about 9500 in each group.

Session 3 Vitamin A in Morbidity and Mortality of Young Children: Asia
Chairperson: Dr. Vinodini Reddy

The Impact of High-Dose Vitamin A on Mortality Due to Measles Associated Pneumonia: A Double-Blind Randomized Controlled Trial in Philippines:
Dr. Marilla G. Lucero †

Measles is an important cause of mortality in the country and responsible for 50% of hospital admissions due to acute respiratory tract infection in young children. Details were given of the design of the ongoing trial. Data are not yet available.

The Effect of Vitamin A Prophylaxis on Morbidity and Mortality Among Children in Urban Slums in Bombay: Dr. Gopa Kothari † ‡

Dr. Kothari presented the results of a study in which over 2000 children under the age of 6 years were followed at 6 month intervals between 1985 and 1988. Children in one slum received megadose vitamin A, nutrition education, and immunization; children in the other slum received none of these. In the experimental group mortality declined in this period from 16 to 3.6 per 1000 among children age 1-5 years. There were declines in respiratory infection, skin diseases, otitis, malnutrition (assessed by weight for age), and diarrheal episodes. Post-measles complications also declined and no xerophthalmia occurred. In the control group mortality remained high (18-20 per 1000) as did morbidity.

The Impact of Mega Vitamin A Dosing With and Without Anthelmintic Therapy on the Vitamin A and Morbidity Profile of Underprivileged School Boys in Baroda, India: Dr. Tara Gopaldas † ‡

Two hundred ten school boys age 9-15 years were randomized into 2 groups and matched by age, vitamin A status, parasitic status and prevalence of morbidity (upper respiratory infection, fever, diarrhea, helminths/protozoa). The experimental group received 200,000 IU vitamin A at 4 month intervals for 1 year; the control group received a placebo. Relative to placebo the experimental group had significantly less morbidity (prevalence, number of episodes, and duration) except for diarrhea.

Mild Vitamin A Deficiency and Risk of Respiratory Infection and Diarrhea in Preschool and School Children in Northeast Thailand: Dr. Martin Bloem † ‡

Among 1772 children age 1-8 years those with a history of diarrhea or respiratory infection had significantly lower serum retinol and retinol binding protein. Follow-up of 146 of these children showed that serum retinol < 0.35 μmol/l was associated with a four-fold increase in respiratory disease in a 3 month period. In 166 children age 1-5 years, those receiving 200,000 IU vitamin A over a 2 month period had 3 times less respiratory and diarrheal disease than the control group.

The Impact of Vitamin A Intervention on Preschool Child and Infant Mortality in Indonesia: Dr. Muhilal †

Two controlled field trials indicated that vitamin A intervention plays a significant role in reducing preschool child and infant mortality. Vitamin A fortification of MSG was carried out in an area with about 5000 children. In a matching area MSG was not fortified. Vitamin A status was assessed before and after the trial and mortality was recorded. In the experimental group xerophthalmia decreased significantly and mortality was 45% less than in the control group.

In a second randomized trial, two groups having 1600 babies each were compared. Mothers in the experimental group were given 400,000 IU vitamin A in the 2 week postpartum period and their babies received 100,000 IU when they were older than 4 months. Control mothers and babies received no vitamin A. Retinol levels in mothers' breast milk and in the serum of babies was significantly increased in the treated group relative to controls. Mortality in the treated group was 29.1 compared with 47.4/1000 live births in the control.

Effect of Single Dose VAC on Breastmilk and Morbidity in Mothers of Low Socio-Economic Status in Bangladesh: Dr. S. K. Roy †

Fifty mothers of low socioeconomic status were given either 200,000 IU vitamin A or a placebo at delivery. Morbidity data for mothers and infants were recorded twice weekly for 1 year. Retinol in serum and breast milk was estimated at 24 hr, 1 month, 3 months, and 9 months after delivery. Both rose significantly in the supplemented group. Morbidity data showed only less respiratory infection in children of supplemented mothers.

Immune Status in Children with Mild Vitamin A Deficiency in Indonesia:
Dr. Richard Semba †

Two hundred thirty-six normal and vitamin A deficient (XN and/or X1B) preschool children were matched for age and sex and randomized to 4 groups in a double-blind clinical trial. Clinically normal and vitamin A deficient children received either vitamin A or placebo. Two weeks later oral polio, intranasal influenza, and intramuscular DPT vaccines were given. Saliva, sera, lymphocytes, and serum retinol were obtained initially and 3 weeks after immunization. The main difference between the treatment and control groups was in the humoral response to tetanus immunization, compatible with an effect of vitamin A on T-helper cells.

Immune Status of Children With Mild Vitamin A Deficiency in India: Dr. P. Bhaskaram † ‡

In 123 children age 1-5 years most functions of the immune response were found not to differ significantly between those with serum retinol above 20μg/dl and those with serum retinol < 20μg/dl. However, the number of T cells was depressed in the latter. The ratio of T-helper/T suppressor-cytoxic cells was not altered. It was concluded that this does not offer a strong immunologic basis for increased susceptibility to infection in mild vitamin A deficiency.

Summary and Programmatic Implications: Dr. Jon Rohde
Discussant: Dr. Saroj Pachauri

Dr. Rohde suggested that available evidence showed that repleting vitamin A stores in deficient populations does effectively reduce mortality. The morbidity issue was less clear and was more complicated as it related to incidence, severity, and complications. Little evidence had been presented concerning any effect on growth. Consideration has to be given to incorporating conclusions into programs of immunization, primary health care, growth monitoring and promotion, nutrition education, and agriculture.

Dr. Pachauri referred to the immense policy and program implications of the research. The results of these complex and difficult studies should be widely disseminated. Most studies reported used megadoses of vitamin A. However, the study in Madurai employed only the RDI given weekly (2500 μg/week) which might be more appropriate in practical terms. Policy questions still require answers. Should this be another vertical program? Should it be incorporated into ongoing programs? Should it be piggybacked onto the Expanded Programme on Immunization (EPI) or other universal immunization schedules? Should it be short or long-term? How long should supplementation continue? Empowerment of women should be part of all child survival programs.

* * * * *

During the general discussion of this major session, views were expressed strongly both for and against vitamin A interventions in primary health care being broadened as a result of the evidence presented at the meeting. It might be considered to be less costly and simpler than vitamin A distribution as part of EPI. The population growth problem would ultimately be helped by the survival of children. It was agreed that awareness of the need for vitamin A for health should be promoted, and that improved dietary intake should be emphasized. Over-enthusiasm was warned against as it has often led to disillusionment and might harm existing programs. EPI (which provides polio vaccine at birth, 6, 10, and 14 weeks; measles at 6-12 months; and boosters for older (1-5 years) children) gives opportunities for adding vitamin A supplementation. UNICEF plans to give nutrition emphasis in the decade of the 1990's. There was consensus that evidence was

stronger for an effect on mortality than on morbidity. This might be because morbidity definitions lacked clarity in terms of identification of the characteristics of diseases of the gastrointestinal, respiratory and urinary tracts. Workers were not yet applying standardized criteria in their research. The difficulties and high cost of this kind of research were stressed, as was the very preliminary nature of most of the work presented.

Session 4 New Assessment Techniques

Chairperson: Dr. Olivier Amédée-Manesme

Transfer Technique Versus the Non-Transfer Technique for Conjunctival Impression Cytology: Dr. Olivier Amédée-Manesme †

The technique of transfer impression was described in this presentation. In this technique, the filter paper is applied by finger pressure only to the infero-temporal quadrant of the eye for three seconds. The cells are then transferred to a slide by pressing the filter paper against the slide. Fixation and staining with the Harris-Shaw method is then carried out. Abnormal histological changes, characterized by loss of goblet cells and enlargement and reduction in number and distortion of shape of epithelial cells were illustrated and related to biochemical indices (serum retinol, RDR, and liver retinol). Specimens were graded into four categories: *normal, marginal (+), marginal (-), and deficient.* Sensitivity and specificity of the test depended upon the evaluation criteria selected. Over 5000 impressions were obtained in 5 African countries, mainly in children age 2-6 years. In 1-20% no imprint was obtained, particularly in younger children, but the rate improved with experience. In regions like the Sahel, the interpalpebral zone of the conjunctiva is an area of exposure metaplasia and is best avoided so the infero-temporal area was used. Simple conjunctivitis did not interfere but inflammatory trachoma did. Response to vitamin A treatment took 1-3 months. Similar results were obtained with the non-transfer and transfer methods, but staining with transfer was simpler and less time consuming. CIC can be used to define vitamin A deficiency as a public health problem. When compared with the criterion of WHO (less than 10μg/dl in 5% of the population at risk), 10.8% of the population (with or without ophthalmic disease) classified as CIC positive (*deficient* or *marginal (-)*) is equivalent to 5% of the population with a plasma retinol less than 10 μg/dl.

Disc Applicator for Assessing Vitamin A Status by Conjunctival Impression Cytology: Dr. Deborah Keenum † ‡

A vacuum pump applicator that applies a disc of acetate filter paper of fixed area to the conjunctiva was described. This procedure reduces time required, diminishes variations in pressure, and eliminates any contact with fingers. CIC disc vs. strip methods were compared in 118 cases of xerophthalmia and 118 controls. The techniques agreed 67% of the time. Approximately 80% of the discordance was due to discs showing more complete transfer with normal epithelium. Abnormal discs correlated closely with low serum retinol.

Use of the Impression Cytology Method with Transfer During a Prevalence Survey on Vitamin A Deficiency in Malawi in 1988: Interest of the Method and Relations with Morbidity and Energy Nutrient Malnutrition: Dr. Alain Jean Escoute † ‡

Impression cytology with transfer was found to be one of the best methods available for assessment of vitamin A deficiency in population groups. Age and indicators of nutritional status were strongly correlated with the test's results. No evident correlation occurred with morbidity.

Vitamin A Deficiency Field Screening by Conjunctival Impression Cytology: A Study of Technology Transfer: Dr. Evangeline Olivar-Santos † ‡

CIC was done on 1730 children in the Philippines who were either cases of xerophthalmia or controls. The procedure had a low sensitivity (25%) which, however, was higher than that of serum retinol (16%). Specificity was high and similar to that of serum retinol (81%).

Assessment of Marginal Vitamin A Deficiency in Thai School Children by Impression Cytology, Dark Adaptometry, and Serum Retinol: Dr. Emorn Udomkesmalee † ‡

In Northeast Thailand, 468 children age 6-11 years old were studied by CIC, dark adaptometry, and serum retinol (in only a 50% subsample). Marginal vitamin A deficiency by serum retinol (< 20μg/dl) was 39%, by dark adaptation time (> 120

secs) was 36%, and by CIC was 16-39% depending on cutoff point. The three tests correlated closely.

Conjunctival Impression Cytology: Comparison to Biochemical Measures and Response to Therapy: Dr. Chris Kjolhede † ‡

Vitamin A status of 175 children age 2-5 years was evaluated by CIC, fasting serum retinol, and relative dose response (RDR). Subjects were randomized to receive either 200,000 IU vitamin A or 50 mg vitamin C. The use of the terms sensitivity and specificity was discussed. CIC results were 18.8% abnormal, 10% unreadable, and the rest normal. In each case there was very good specificity but poor sensitivity and positive predictive value for CIC in relation to the different criteria of serum retinol or RDR. Mean serum retinol and CIC interpretation did not correlate well.

Rapid Appraisal of Community Vitamin A Status Through School Children in Zambia: A Comparison of Assessment Approaches: Mr. David Mwandu † ‡

The researchers examined 1254 preschool and school age children from a range of socioeconomic backgrounds. Clinical signs, dark adaptation test, serum retinol (using PAHO criterion of 15% with 10-19μg/dl as positive), RDR, and CIC correlated well in revealing a vitamin A deficiency problem in the lower socioeconomic group.

Biochemical Assessment of Vitamin A Deficiency: Serum Distribution Curves Relative to the RDR Test Before and 30 Days After High Dose Supplementation: Dr. Hernando Flores † ‡

Data from about 2000 children were used to correlate serum retinol levels, RDR, and the 30 d response of serum to a megadose of vitamin A (S30DR). These three indicators were very highly correlated. The x intercepts for the regression curve of S30DR and RDR were 49.8 and 52.8 μg retinol/dl respectively. This suggests that these three indicators can be used to assess populations. After high dose supplementation in 724 children the mean serum retinol level was 51 +/- 14 μg/dl and the 95% CI was 29 to 83 μg/dl. Together with the previous results, these data suggest that an adequate serum retinol might be considered to be above 30 μg/dl with a usual level of 50μg/dl.

New Methods for the Assessment of Vitamin A status: Dr. James Olson † ‡

The Relative Dose Response (RDR) of Underwood and coworkers has been shown to give a positive (abnormal) response, indicative of reduced liver reserves, when an increment of 20% or more in plasma retinol value from 0 h to 5 h with respect to the 5 h value occurs. The requirement of two blood samples, 5 h apart, limits application in the field. A new test, Modified Relative Dose Response (MRDR), was described. In it 3,4-dehydroretinol (100μg/kg) is given orally 4-8 h before a single blood sample is taken. This compound (vitamin A_2) found in the liver of fresh water fish is not significantly converted to retinol (A_1), does not affect initial plasma retinol, and is readily separated by HPLC. The molar ratio of A_2/A_1 is inversely related to vitamin A status.

The procedure has been validated in rats and also studied in Iowa and Indonesian children. A ratio of 0.03 has been proposed as a cutoff point for separating normal and abnormal vitamin A status. A method using isotope dilution to estimate total body vitamin A reserves has been described. A large oral dose of tetradeuterated retinol is given and blood samples are taken up to about 47 days later. Deuterated and nondeuterated retinol are measured by gas chromatography linked to mass spectroscopy. Values estimated in this way have been found to be highly correlated with concentrations measured in liver biopsy samples taken at surgery. The procedure is not yet suitable for survey purposes.

* * * * *

In the discussion following this session it was noted that most working with CIC have generally found it to be a valuable technique for assessing marginal vitamin A status. Some, however, report low sensitivity and predictive value. There are differences in obtaining and processing the specimen, and considerable variation exists in the interpretation of the appearances and how to categorize them. It was generally agreed that reversal of histological changes by vitamin A might take as long as 1-3 months. The new disc applicator appears to offer some benefit. Most agree that more experience on these points of difference is required before this

technique can be applied routinely, but that it does constitute a most promising advance in the methodology for detecting early vitamin A deficiency.

The view was expressed that with the advent of RDR, and especially the more practicable MRDR, significant advance had been made towards setting up criteria for the lower limit of the physiologic adequate status of vitamin A at the field level.

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Also during this session, the participants paid tribute to Dr. C. O. Chichester who recently retired from the IVACG Secretariat due to ill health. He had been associated with IVACG for many years and had been instrumental in the creation of the secretariat. His efforts behind the scenes contributed significantly to ensuring the quality of various IVACG activities over the years. All wished him well in his retirement and a vote of appreciation for his contributions was recorded.

Session 5 Strategic Considerations for Applied Programs

Chairperson: Dr. Benny A. Kodyat

Management of Community Based Intervention Programs: Mr. R.D. Thulasiraj ‡

An account was given of experience gained in the Madurai Vitamin A Intervention Program in India. This program employs 309 people and involves weekly contact with 15,419 children, administration of a dose (vitamin A or placebo) to them, and collection of daily morbidity data for a period of 52 weeks. Mr. Thulasiraj discussed manpower planning, selection, training, and management; management of field activities; the communication and information system; data management; money management; and quality control. He concluded that the key factors to managing a large intervention program include teamwork, commitment from the senior members, and an uncompromising attitude towards quality. This spirit governs the program described, and ultimately its success.

Practical Experience in the Use of the Calibrated Plastic Dispensers in the Field:
Mr. Raheem Rahmathullah ‡

Experience in the Madurai Vitamin A Intervention Trial suggested that the dispensing bottle can be used effectively in the field by village volunteers and is durable under field use conditions. The bottle should be used at an angle of 45 degrees for accurate dispensing. When vitamin E is present as an antioxidant, the vitamin A is quite stable in bottles exposed to temperatures as high as 42°C. Bottles need to be checked for defective nozzles and screw tops before distributing to field workers. Workers need to be aware that an air lock can develop when bottles are opened for refilling and this air lock must be relieved before accurate dispensing can occur. It was concluded that dispenser bottles provide a flexible, accurate, low cost, and safe delivery system for vitamin A intervention programs using the primary health care approach.

Tolerance of Preschoolers to Two Dosage Strengths of Vitamin A Preparation:
Dr. Rodolfo Florentino † ‡

These were tested in a double blind study on 2471 children age 1-6 years. None were suffering from xerophthalmia, nausea, vomiting, fever, headache, or diarrhea. They were randomly given 1 ml syrup suspension containing either 200,000 IU vitamin A, 100,000 IU vitamin A, or a placebo. Almost all (89%) of the study population, irrespective of treatment group, reported positive reactions. About 7-9% of the placebo group complained of at least 1 symptom within 24 h (community incidence estimated at 3%). Nausea and/or vomiting occurred in 8.8% and 3.6% of children given 200,000 IU or 100,000 IU, respectively, while headache was reported in 5.9% and 2.0%, respectively. Diarrhea and fever did not differ significantly between the three groups. Symptoms were more common in younger children and in those of poorer nutritional status. It was concluded that considering the low incidence of serious intolerance, the prophylactic regimen recommended by WHO (i.e., 200,000 IU every 4-6 months) should be pursued.

Under What Conditions are Vitamin A Deficiency Control Programs Competitive with Other Survival Strategies? Experience in Indonesia: Dr. Robert Tilden † ‡

A comparison was made of the level of health benefits produced by vitamin A interventions under varying levels of mortality reduction, with different child survival strategies such as immunization, MCH services, ORT promotion, and basic improvements of health centers. Mortality reduction levels estimated by Muhilal in West Java and Sommer in Aceh (35%) were used as optimistic figures for initial comparison. Holding cost constant, several lower levels of mortality reduction (20%, 10%, 5%, 2.5%, 1%) were applied to explore a threshold level of mortality reduction below which vitamin A deficiency control would no longer be the preferred approach to improve health status. The cost-effectiveness model developed by Grosse and Tilden was used. The cost of vitamin A treatment varied between US $0.20 - US $2.00; the cost of prevention was between US $1.00 - US $25.00. Prevention was more effective than treatment if carried on long enough. Prophylactic vitamin A and EPI were synergistic. The preferred approach was to combine treatment, prevention plus vitamin A, and other measures.

Control of Vitamin A Deficiency and Xerophthalmia in Vietnam: Dr. Ha Huy Khoi † ‡

Epidemiological surveys were carried out on 25,782 preschool children in 13 provinces and revealed a serious xerophthalmia problem. A national program for control of vitamin A deficiency was established with UNICEF support. This included training of health personnel, universal distribution of a megadose capsule for children age 6-36 months and lactating women, targeted distribution for those at risk, a home garden program, and monitoring of activities. In 1989 the first evaluation data are expected plus acceleration of vitamin A distribution.

Update on the Experiences and Applications of *Guidelines for the Development of a Simplified Dietary Assessment to Identify Groups at Risk for Inadequate Intake of Vitamin A*: Dr. Luthfor Ahmed † ‡

A weighed intake survey of household dietary intake for 3 consecutive days was conducted in 112 households in two different ecologic regions of Bangladesh. Individual intakes of 2-5 year old children were measured. Each day of the weighed intake survey was followed by a 24 h recall survey using the IVACG

method. There was good agreement on a population basis between the consumption index (CI) scores with the weighed intake survey and the simplified recall method. The study, supported by FAO, also showed the usefulness, as the IVACG method advises, of supplementing 24 h intake estimates with information on usual consumption pattern (UPF), in different seasons.

The FAO Vitamin A Regional Network: Ms. Teresa Calderon

In October 1985 a UN Action Program was launched to reduce vitamin A deficiency and its ocular consequences to a level where it no longer would constitute a public health problem. Preparatory work for the establishment of a Regional Vitamin A Network in Asia has been undertaken to help accelerate national programs during a workshop organized by the Ministry of Agriculture and FAO in Jakarta, Indonesia in February 1989. Twenty-five participants attended from Bangladesh, China, Indonesia, Philippines, India, and Nepal. UNICEF and Helen Keller International (HKI) attended as observers.

Home Gardens as a Practical Measure to Combat Vitamin A Deficiency: Dr. Y. H. Yang † ‡

A well managed (no insecticide application), mixed garden of only 200 square feet (18 square meters), with sequential cropping of highly nutritious vegetables can supply a family of 5 persons the following percentages of their RDA: energy 2%, protein 10%, iron 27%, calcium 35%, vitamin A 219%; and vitamin C 198%.

Experience of home garden programs in Taiwan, Guatemala, Philippines, Republic of Korea, Jamaica, and China suggests that perennial crops including malumggay, edible hibiscus, and sesbania grandiflora be planted along with annual crops. Soil fertility and moisture conservation can be achieved through recycling of organic materials, deep digging, mulching, contouring, and green manuring.

Session 6 Country Reports
Chairperson: Dr. Alawia El Amin

Thailand: Dr. Yongyout Kachondham † ‡

Thailand does not have a national vitamin A program. Small scale surveys suggest that vitamin A deficiency is a marginal problem in areas of rural northeast communities. There are two kinds of programs at present: prevalence surveys in high risk areas of the country and research models for vitamin A strategy, e.g., nutrition education and school lunch activities.

Bangladesh: Ms. Flora Sibanda

For 16 years UNICEF assisted with capsule distribution aimed at every child in the target age group. An evaluation carried out in 1978 showed that the urban sector was neglected and that coverage was not more than 45%. Poor management and supervision and lack of training were partly responsible. The government, HKI, UNICEF, and local NGOs are now trying to address the problem. A massive training program for NGOs with health workers in 32 cities was being undertaken and monitoring had started. Vitamin A is being added to EPI for those under 1 year and up to 2 years. A midterm evaluation of operations, night blindness, and mothers' knowledge showed a discrepancy between "coverage" (79%) and "consumption" (37%). Increasing intake by social marketing and home gardening is being pursued.

India: Dr. K. Vijayaraghavan

Xerophthalmia rates for children less than 5 years of age had remained around 5-10% over a number of years with an estimated 80,000 corneal cases and 50% blind annually. The National Program was started in 1970 and all states are now covered with about 25 million preschool children receiving megadose vitamin A (i.e., about one third of those eligible). An evaluation in 1979 showed imperfect implementation in many instances attributed mainly to the fact that multipurpose health workers were being used. In 1988 there was an expert committee review which recommended a link with EPI. In the EPI program 80% coverage is expected and monitoring and supervision are good. Vitamin A would be given at 1 1/2 years of age with booster and after 2 years by Integrated Child Development

Services (ICDS) which has 40% coverage at present and is taking on 500 new blocks per year. These measures are, however, only short term. There is no suitable food for fortification. Nutrition education and horticulture interventions have been started in 3 states.

Indonesia: Dr. Benny A. Kodyat ‡

Vitamin A deficiency has long been recognized to be a serious public health problem in most of the country. Since the National Prevalence Survey in 1978, prevalence studies have been undertaken in limited areas that demonstrate a dramatic improvement. While many factors are probably responsible for this change, it is not unreasonable to give some of the credit to the vitamin A deficiency control program. The megadose 200,000 IU vitamin A capsule was introduced in 1972 but required constant supervision to maintain effectiveness.

The National Prevalence Survey in 1978 revealed vitamin A deficiency as a public health problem in 15 of the 24 provinces covered. The magnitude of the problem has been significantly reduced in most of these provinces in recent years. The capsule program was later integrated into the family nutrition improvement program (abbreviated UPGK) which includes nutrition education. Eventually UPGK was integrated into the Pos Yandu (village level contact for ministry of health), that also includes diarrheal disease control, promotion of immunization, family planning, and MCH. Other approaches such as "Vitamin A Week" or "Vitamin A Month" have also been used in some areas. Fortification has been mainly with MSG and a pre-national study is now being carried out in three provinces. The Ministry of Health places strong emphasis on monitoring and evaluation. The use of cost effectiveness analysis of alternative programs has assisted strategic planning.

Philippines: Dr. Manuel G. Roxas

A new 5 year plan started in July 1989. Nutrition will be integrated into MCH. There are 20 programs in public health including promotion of breast feeding; nutrition education through mass media; mothercraft; and targeted vitamin A capsule distribution for 2d and 3d degree malnutrition, measles, and disasters. Enrichment of rice and MSG with vitamin A is being reviewed. Training of health personnel is underway.

African Regional Report for French-speaking West Africa: Dr. Joseph Diallo ‡

A report on the vitamin A status of countries in West Africa was presented.

Benin: Vitamin A deficiency is prevalent in the north. There is no national program.

Burkina Faso: The whole country is affected, especially nomads and semi-nomads. HKI is operating its Vitamin A Technical Assistance Program (VITAP) here.

Cameroon: Although there is no data, vitamin A deficiency is likely to occur in the north.

Ivory Coast: It is reported that a program against malnutrition, including vitamin A deficiency, will be launched in the center of the country. There is biochemical evidence of deficiency.

Guinea: Not investigated

Mali: Deficiency was detected in the north in 1975 and 1986. HKI held a seminar in Bamako recently and a program is planned in the region of Segou.

Mauritania: Vitamin A is part of a program to prevent blindness. There is a countrywide campaign in preparation to distribute vitamin A to children and to pregnant and breast-feeding women.

Niger: Several surveys using eye signs have shown the presence of a problem, especially among nomads in the north. HKI and USAID are involved. The government has included it as part of the public health program.

Senegal: Data are not available.

Chad: Sporadic cases are reported to occur and some capsule distribution is being done.

Togo: Deficiency is suspected in the north but no data is available.

Dr. Diallo determined that there should be collaboration between concerned organizations such as WHO, IVACG, UNICEF, World Vision, HKI and others.

<u>African Regional Report for English-speaking Africa</u>: Dr. Moses Chirambo ‡
(Due to Dr. Habte's early departure, Dr. Chirambo presented the report for both English-speaking IVACG African regions.)

Tanzania: A national program has been implemented and there is a national group that coordinates activities. Emphasis is being given to horticulture and red palm oil. Several regions are severely affected where capsules are used for treatment and targeted at risk groups. Nutrition education is well developed. Research has been undertaken especially on measles and vitamin A.

Malawi: There is a problem mainly in Lower Shire and some other districts. Capsules are used for treatment and targeted. There is coordination of health and agriculture.

Zambia: A survey in Luapula valley revealed a serious problem in 1985. A public health program has not yet been implemented.

Mozambique: In 1987, 3790 refugee children in Zambesia were found to have rates of eye signs exceeding WHO criteria. Capsules are being distributed.

Ethiopia: The whole country is potentially at risk but especially the pastoral people. A program has been designed but not implemented.

Sudan: The magnitude of the problem has been established and a program designed. Capsules are used for treatment, and

education and horticulture measures are used. A study on morbidity and mortality is taking place.

Ghana: Hospital data suggest a problem mainly in the north, where an intervention trial is taking place.

Nigeria: The north is the main area of concern.

For Kenya, Angola, Burundi, Rwanda, Uganda, and Zaire data are insufficient but a public health problem is suspected. In Botswana, Zimbabwe, Lesotho, and Swaziland only sporadic cases have been reported and it is not likely to be a public health problem.

In conclusion it may be suggested that the situation is worsening throughout the continent due to drought and famine, population increase, economic depression, and civil strife.

Brazil: Dr. Hernando Flores †

It is generally agreed that vitamin A deficiency is a problem of public health magnitude in northeast Brazil. The National Institute of Foods and Nutrition (INAN) coordinates a program of distribution of megadose vitamin A in 8 states of northeast Brazil through the national polio campaign. Coverage is irregular. Several food supplementation programs have been in effect since 1980. Coverage depends on availability of funds which is irregular and scarce. INAN promotes programs to encourage breast feeding. One state and one municipal program in Paraiba and Caruaru have decreased prevalence of eye signs and, in the latter, internal demand gives some guarantee of continuity.

Vitamin A Status Survey of Myanmar Children: Dr. Moe-Moe-Sunn † ‡

In three areas of the country, 1015 children age 2-14 years had eye and physical examinations and serum retinol measured. These tests provided evidence of a public health problem in the dry zone areas of upper Myanmar.

Western Pacific Islands: Dr. Michelle Puryear

On the Micronesian island of Truk in the course of a year 4 young children presented to the hospital with keratomalacia. A preliminary study in an outpatient clinic indicated that more than 10% of children had xerophthalmia (XN and X1B) and more than 50% had abnormal CIC. In a population-based study preschool children were found to have X1B (5%) and abnormal CIC (30%). This important public health problem is being further investigated.

Session 7 Agency Reports

Chairperson: Mr. Anish Barua

Food and Agricultural Organization of the United Nations (FAO): Ms. Teresa Calderon

Reference was made to the UN 10 Year Vitamin A Programme and the participating international agencies. FAO's Food Policy and Nutrition Division coordinates various activities in FAO to cover the long-term and preventive aspects of this program based on agricultural (fruits and vegetable and palm oil production) and educational (nutrition education, nutrition in primary schools teaching) interventions. The strategy of FAO's program contribution is through a three pronged approach: FAO assists governments, harnessing the technical expertise and resources of ongoing FAO projects in nutrition, agriculture and rural development, horticulture and the traditional food crops programs; it assists to develop and implement new specific country projects; and it collaborates with other UN agencies, the partners of the Ten Year Programme, and with international non-governmental agencies including IVACG. Since 1986 various activities and projects have been undertaken and are planned in 17 countries in Asia, Africa, and Latin America. Current development of project proposals involves approximately 7.5 million U.S. dollars.

United Nations Children's Fund (UNICEF): Dr. V. Ramalingaswami

In January 1989 the WHO and UNICEF Joint Committee on Health Policy endorsed a health strategy for the 1990's that included a strong nutrition component. Its goals include reduction of measles mortality by 90% and morbidity by 95%, and

elimination of blindness and other consequences of vitamin A deficiency. In September 1990 a World Summit on Children will be held, the first in the history of world leaders. It is expected that on 20 November 1989 the Convention on the Rights of Children will be endorsed by the UN General Assembly. This will include adequate nutrition. UNICEF is one of the sponsors of the March 1990 Conference on Basic Education for All which will be held in Bangkok.

In 1989 UNICEF distributed a record number of 105 million vitamin A capsules to 17 countries. Other activities include training, kitchen gardens, and women's voluntary groups. UNICEF is exploring the inclusion of vitamin A distribution with universal childhood immunization in a number of countries.

World Health Organization: Dr. Graeme A. Clugston

WHO has been involved with the problem of vitamin A deficiency for many years. Two technical reports and a monograph have been produced in close collaboration with IVACG. The ACC/SCN launched the global program based on the World Health Assembly of 1984 already referred to. At WHO headquarters, EPI plus vitamin A is being pursued and started in various forms in 8 countries. Under the Program for the Prevention of Blindness, WHO national blindness prevention programs exist in 62 countries, including Nepal, and primary eye care is promoted. Vitamin A deficiency has a high priority in the Nutrition Program, and a global monitoring and surveillance system is being developed with HKI. National programs are also being supported.

WHO Programme for the Prevention of Blindness: Dr. A. D. Negrel

The main thrust of this WHO program is the reduction of easily avoidable blindness in countries where this constitutes a major public health problem. Xerophthalmia is one of the main diseases concerned. Establishment of national blindness prevention programs in all appropriate countries by 1995 is a goal. These national programs are based on primary health care and include both control of specific blinding diseases and provision of essential eye care for all. Within WHO, the Programme maintains close collaboration with the Nutrition Unit and other programs concerned with follow-up action at the national level where xerophthalmia control forms part of the national blindness prevention program.

U.S. Agency for International Development: Dr. Norge W. Jerome

Over the past 3 years the U.S. Agency for International Development has spent U.S. $22 million in the vitamin A deficiency area. Its objective is to assist countries to develop, implement and evaluate national programs for the elimination of vitamin A deficiency. AID has a 3-fold focus and 5-fold strategy. The focus is (1) to validate the role of vitamin A deficiency in childhood morbidity and mortality, (2) to fund interventions, training, and institution building for sustainable country programs, and (3) disseminate state-of-the-art information. The strategy consists of (1) assessment, which is currently going on in 22 countries; (2) research in 17 countries, including that of many workers presenting their reports at this meeting; (3) interventions in 18 countries, including nutrition education, social marketing, food fortification, horticulture, and capsule delivery (a number of NGOs are being assisted in this way); (4) training in 25 countries; and (5) information collection and dissemination which now includes support of ISTI for field support activities.

Ford Foundation: Dr. Saroj Pachauri

The work in India was described as a three-fold program on child survival and women's health. It supports (1) policy-relevant research, (2) strengthening epidemiology and health management, and (3) innovative projects largely through NGO's. Vitamin A field support is being given in India to the Aravind project in Madurai and to Dr. Gopaldas' program in Baroda. Ford Foundation also supports a megadose vitamin A program in Varanasi and a post partum vitamin A program in West Bengal.

National Eye Institute: Dr. Barbara A. Underwood

National Eye Institute (NEI) is one of 12 institutes of the National Institutes of Health, USA, founded in 1968. Its major role is in the USA with 6 major programs and more than 1500 projects. In the vitamin A area there are both intramural and extramural basic science studies being supported. Internationally NEI staff have a technical and advisory capacity in India, Brazil, Bolivia, Nepal, and Zambia. NEI is closely associated with IVACG task forces, the IVACG Steering Committee, and WHO.

International Development Research Center (IDRC): Ms. Jenny Cervinskas †

IDRC was set up by the Canadian government in 1970 as an autonomous international board to provide funding for research applied to human needs in third world countries. The headquarters are in Ottawa; there are 6 regional offices and over 400 staff members. Health Sciences is one of 7 divisions and within this a nutrition unit is action-oriented and community-based. Vitamin A programs are being supported in a number of countries.

Session 8 Nongovernmental Organization Reports

Chairperson: Ms. Susan Eastman

Task Force Sight and Life: Dr. John Gmunder †

This was started early in 1986 by Hoffman-La Roche & Co., Ltd. with three objectives: scientific and technical support; research, development, and training; and donations of free vitamin A in emergency situations. Liquid vitamin A dispensers have been developed and assistance given for their field testing. The main focus is on vitamin A intervention support. Task Force Sight and Life has assisted a total of 87 projects in 33 countries.

Helen Keller International: Vitamin A Technical Assistance Program (VITAP): Ms. Susan Eastman

As HKI approaches its 75th anniversary all the current programs in the third world were well represented at this meeting. HKI involvement in the vitamin A field started in Indonesia where the research eventually led to the child survival hypothesis. HKI now acts as a catalyst to programs in 10 countries. Activities include field assessment, demonstration projects, materials development, monitoring and evaluation, choices and strategies, social marketing, nutrition education, food fortification, capsule distribution, and emergency interventions. Over many years collaboration has been maintained with UN and nongovernmental organizations throughout the world and significant support has been received from USAID. This now includes 5 year funding for VITAP to work in 20 countries targeting the NGO community with workshops at various levels, information gathering, and networking to link public and private sectors.

Catholic Relief Services: Mr. Richard Renas

Control of vitamin A deficiency among 24,000 primary school children in a poor area of northeastern Thailand was described. A package of interventions consisting of improved food habits, sustainable school lunch program, nutrition education, health promotion, and training of teachers was being assessed by CIC, serum retinol, dark adaptometry, and dietary recall. Student attendance and profitability of agricultural activities were being monitored.

Nepal Netra Jyoti Sangh: Dr. R. P. Pokhrel

The National Society for the Prevention of Blindness in Nepal (NNJS) has grown greatly over the 10 years of its existence. Within 5 years it plans to have one eye center in each development zone and by the year 2000 to have one ophthalmologist for each 100,000 persons and one eye bed per each 10,000 persons. Each general hospital has 8-10 eye camps per year and within 5 years it is expected that there will be no backlog of cataracts and no further need for eye camps. Two vitamin A research projects reported at this meeting are being undertaken with the participation of NNJS.

Cristoffel Blindenmission: Dr. Allen Foster

About 800,000 individual donors worldwide support Cristoffel Blindenmission (CBM). Through 8 field offices CBM works through local voluntary organizations, other NGO's, and governments. Eye care constitutes about 80% of the medical work, carried out through primary health care services among high risk groups. Training to **a**void **b**lindness in **c**hildren by example and to **a**bolish **b**lindness due to **c**ataract are major objectives.

Sight Savers (Royal Commonwealth Society for the Blind): Dr. Gopa Kothari

In 1980 Royal Commonwealth Society for the Blind (RCSB) launched a comprehensive health care package at 22 project sites. This package covered 100,000-200,000 people and consisted of eye care, oral rehydration, immunization, promotion of breast feeding, growth monitoring, and kitchen gardens. Five years later 14 projects served 40,000 children and mothers. Evaluation in 1986 and 1988 judged that among the benefits, the sight of about 5000 children had been saved and nutritional status was improved. In three contrasting locations (Tiripati, Kanpur, and Jodhpur) sustainable integrated projects will begin in December with the intent of broad replication later.

International Eye Foundation: Dr. L. Schwab

IEF has been working for 30 years in about 40 countries in the third world. About 50% of the support comes from AID. Work has shown that in Zimbabwe 20% of blindness was corneal. IEF has worked in Lower Shire valley of Malawi since 1985.

IVACG Secretariat Report: Dr. Timothy Morck

Dr. Morck thanked all who helped make the meeting such a success. Two task forces are completing their work. One is developing a manual for program managers that will include successful ways to communicate health messages concerning prevention and control of vitamin A deficiency. The other task force is writing a monograph on the integration of vitamin A distribution with immunization programs.

Since the last IVACG meeting in 1987, an IVACG/WHO/UNICEF task force prepared *Vitamin A Supplements: A guide to their use in the treatment and prevention of vitamin A deficiency and xerophthalmia*. Three other new publications are also available from the IVACG Secretariat: *Guidelines for the Use of Vitamin A in Emergency and Relief Operations, Methodologies for Monitoring and Evaluating Vitamin A Deficiency Intervention Programs*, and *Guidelines for the Development of a Simplified Dietary Assessment to Identify Groups at Risk for Inadequate Intake of Vitamin A*.

The date and site of the next IVACG meeting will be considered at the next IVACG Steering Committee meeting.

Closing Remarks: Dr. Abraham Horwitz

"We celebrate this year the 76th Anniversary of the discovery of vitamin A by E. V. McCollum. I had the honor to be his student at the Johns Hopkins School of Hygiene and Public Health, 45 years ago. He taught us nutrition. I remember well how modest he was, despite the greatness of his spirit and the significance of his discoveries for the well-being of the people. With the arrogance of the young, we underestimated the social consequences of the message he was conveying to us, namely, that vitamin A was essential for normal growth, resistance to infection, and maintenance of ocular integrity. Still, something must have remained in me to explain why, so late in my life, I find myself actively involved in cooperating to free the developing world of the scourge of vitamin A deficiency.

"As the best of the XII that preceded it, this XIII IVACG Meeting fulfills to a large extent the conditions established by Dr. McLaren in his excellent review of the first 10 years of IVACG. 'The foresight of those that created IVACG has made it possible for a free exchange of ideas to occur at meetings between administrators of governmental and non-governmental organizations and scientists from many disciplines working on the problem in the laboratory, in the hospital, and in the field. This form of free exchange has proved to be of mutual benefit in that administrators have been kept abreast of the latest scientific developments and scientists have been made aware of the logistical framework and requirements for funding of their proposed activities.'[1]

"I believe that this very active interchange of ideas and experiences between those promoting the art with new knowledge, and those advancing the art with new experiences has also occurred in this IVACG meeting. And it has been a rich dialogue. It has dealt with the issues of major concern for governments, the international community of agencies, and the community of scientists interested in vitamin A deficiency and its consequences. Out of a complex and diversified agenda, we single out three major issues: vitamin A in morbidity and mortality in children; new assessment techniques; and the reports on country programs and of multilateral, bilateral, and non-governmental organizations.

"With reference to the impact of vitamin A on morbidity and mortality of children under five, we all came to the IVACG meeting full of hope that the fundamental observations of Sommer and his colleagues in Aceh, Indonesia, would be confirmed in other ecological and cultural settings where incidence and prevalence of vitamin A deficiency as well as food availability, eating patterns and health problems, may be different. We expected morbidity and mortality rates to be significantly reduced as compared with placebo-controlled groups, linear growth increased, and hemoglobin levels raised.

"At this meeting, additional data which confirm previous reports was presented from research projects in India, showing that improved vitamin A nutrition of preschool children reduces mortality. Data from Thailand, Indonesia, and some other countries, suggest that vitamin A deficiency also increases childhood morbidity and that improving vitamin A nutrition of deficient children will reduce their rate of death and blindness.

"In interpreting the sense of the XIII IVACG Meeting, I believe that we can all agree that where vitamin A deficiency constitutes a significant public health problem, governments should initiate and/or extend appropriate programs for improving vitamin A status, recognizing that deficiency generally exists within an environment of multiple deprivations that also require attention.

"Ongoing intervention trials will better define the level of impact that improved vitamin A nutrition will have in populations with different geographic, socioeconomic, and disease patterns and, thereby, assist government planners in choosing between alternative strategies and allocation of health and nutrition resources. Continuing research is needed to assess the mechanism(s) by which vitamin A exerts its effects, the impact that supplementation may have on less severely deficient populations, and the development of better methods for assessing and improving vitamin A status. In addition, operations research is needed to better identify constraints and barriers to implementation of various interventions as well as to improve the quality of services delivered. Better outputs and outcomes could be obtained with available resources.

"James Olson, who has kept high the torch of basic research on vitamin A stated that, 'on a more metabolic tack, the role of retinol-binding proteins needs to be

better defined and the mode of action of nuclear retinoid receptors needs further to be clarified. Ultimately, an understanding of the sequence of events in retinoid-dependent genetic expression will tell us much about the important role of vitamin A in cellular differentiation.'[2] All of this is essential knowledge that should lead to better programs.

"Again, we must praise the analytical mind of Dr. Sommer and the true stroke of a genius reflected in his original research in Indonesia. He saw what many with similar information could not see, nor could they foresee the projections of the value of vitamin A beyond preventing nutritional blindness. When all results are put together, this may become a fundamental breakthrough in the history of vitamin A deficiency and public health.

"The evidence that emerged from this meeting and the outcomes of studies underway should be carefully analyzed by the United Nations Subcommittee on Nutrition (SCN) and its member Agencies in order to decide on policy implications. The question is, should vitamin A interventions be integrated regularly in the primary health care armamentarium to reduce morbidity and mortality of under fives, due to acute infections? Many of us believe that this should be done. I submit that the best forum for this highly significant decision is the forthcoming World Nutrition Conference sponsored, up to now by WHO and FAO, to be held in 1992. We hope that other major agencies, such as the World Bank, UNICEF and UNESCO will also join to ensure well planned discussions on the basis of the best scientific evidence available on nutrition problems. IVACG should play a very active role in the planning phase of the Conference.

"You will recall how well Barbara Underwood defined the deprivation syndrome that constitutes essentially vitamin A deficiency and the interaction of economic, social, and ecologic factors as its major determinant. She stated, 'past approaches have emphasized a universal distribution of supplemental vitamin A, an appropriate intervention in situations where clinical deficiency is a public health problem. Clearly, there is need to rethink strategies for vitamin A depletion and deficiency prevention and control. Future programs for depleted and marginally deficient populations of children need to be more community-oriented. Proposed interventions should take into consideration the context into which they will be implemented in relationship to the community's overall needs for social, economic,

and ecologic development. It may take longer, but only when this occurs will intervention strategies lead to a sustainable long-term solution.'[3]

"Significant progress has also been made in new assessment techniques, particularly with conjunctival impression cytology and relative dose response. We heard a series of studies on the use of these two technologies but mainly the former. It became evident that more and larger ones are needed to clearly establish under field conditions their advantages and limitations. In the case of the relative dose response and the modified relative dose response proposed by Olson, the need for biochemical facilities can be solved, including regional laboratories when appropriate. On the other hand, its validity and limitations need to be clearly established and its practicality for surveys demonstrated. Still, both methodologies are fundamental contributions to a more precise assessment of vitamin A deficiency. We all hope that new tests--particularly non-invasive ones--will be discovered.

"The reports from countries and the international community of agencies show progress in diverse degrees. A common denominator is that better information is available for defining country situations, particularly in Asia. We were all very pleased with the quality of the presentations. As a general observation, the demand for services seems to be greater than the supply of them, particularly when marginal vitamin A deficiency, with all its impending consequences, is taken into account.

"The need for the evaluation of processes, i.e., monitoring of actions performed and of impacts, seems apparent. Some of us would like a common methodology, such as the one proposed by IVACG, to be used in each program. A focal point should be established, for instance, at WHO headquarters, to register the evolution of vitamin A deficiency in the world and report to all governments concerned and the community of agencies providing technical cooperation and/or financial support. We will all then be informed and learn from successes and failures of programs to reduce vitamin A induced blindness, and rates of morbidity and mortality of acute communicable diseases in children under five. Governments and international organizations could readjust programs on the basis of more attainable objectives and available resources.

"I am very happy to note that Dr. Norge Jerome, the Director of the Office of Nutrition of USAID has assured her continuous support of IVACG and its future activities. I cannot help to think how pleased Dr. Martin Forman would have been with this meeting for the quality of the contributions towards reducing the impact of vitamin A deficiency and the effectiveness of its organization. As we all know, he created IVACG and envisioned its future.

"In bringing the XIII IVACG meeting to an end, I would like again to thank His Majesty's Government for the invitation and the facilities provided, Dr. Pokhrel and the organizing committee for their invaluable assistance, all speakers and discussants of the different subjects for their interesting, although sometimes controversial contributions, that made this a memorable meeting in the history of IVACG.

"I wish you all a safe journey on your return home. I declare the XIII IVACG Meeting closed."

[1] IV. What is IVACG? In: A Decade of Achievement: The International Vitamin A Consultative Group (IVACG), 1975-1985. A Report of the International Vitamin A Consultative Group, Washington, D.C., September, 1987.

[2] Dr. J. A. Olson, Department of Biochemistry and Biophysics, Iowa State University. Vitamin A. Paper presented at the XIII Meeting of the International Vitamin A Consultative Group (IVACG). Kathmandu, Nepal, November 1989.

[3] Dr. B. Underwood. Intervention Strategies and Long-Term Solutions in the Prevention and Control of Vitamin A Deficiency. Paper presented at the XIII Meeting of the International Vitamin A Consultative Group (IVACG). Kathmandu, Nepal, November 1989.

Acknowledgements

Many organizations and individuals contributed to the success of the National Symposium and XIII IVACG Meeting. The IVACG Secretariat especially wishes to acknowledge the support and financial contribution of His Majesty's Government and UNICEF Nepal. The organizational efforts and abundant hospitality of the Local Committee for the National Symposium and XIII IVACG Meeting enabled meeting participants to appreciate Nepal's sociocultural environment. They did this not only through the excellent presentations during the National Symposium but also through the impressive opening ceremonies, cultural program, reception, and their day-to-day camaraderie during the meeting. Dr. Keith P. West, Jr. and Dr. Robert Tilden offered continuous encouragement and assistance throughout the meeting planning and execution. Additionally, they fearlessly volunteered their leadership for the site visits to Sarlahi and Chitwan following the meeting. We are grateful as well for the cheerful and conscientious contributions by the local administrative and secretarial staff.

The IVACG Steering Committee devoted many hours to maintaining the scientific quality of the meeting and diligently endeavored to bring attention to programs and studies in the developing world. We thank the session chairs for their firm guidance which enabled the meeting to proceed according to a very tight schedule.

Refreshments provided generously throughout the meeting by Nepal Bottlers, Ltd. and The Coca Cola Company contributed to the social atmosphere between sessions. We thank the Bluestar Hotel for their tireless assistance to make our stay in Nepal comfortable.

The well-prepared presenters as well as the responsive audience provided the interactive component that fosters creativity. The true measure of success of the National Symposium and XIII IVACG Meeting will be determined by the ideas implemented by the participants in the future.

Program

National Symposium

and

XIII IVACG Meeting

National Symposium and XIII IVACG Meeting

Kathmandu, Nepal
5-10 November 1989

Saturday, 4 November 1989: Registration for National Symposium and XIII IVACG Meeting

1300-1700 Lobby, Bluestar Hotel

Sunday, 5 November 1989: National Symposium

0845-0930 Transportation from the Bluestar Hotel to the Royal Academy Hall

0930-0945 Seating at the Royal Academy Hall

1030-1200 **Inauguration by Her Majesty, Queen Aiswarya Rajya Laxmi Shah**

Dr. R.P. Pokhrel, Co-Chairperson, Local Committee for National Symposium and XIII IVACG Meeting; Executive Director, Nepal Eye Hospital; Secretary General, Nepal Netra Jyoti Sangh

Mrs. Sushila Thapa, Minister of Health, Nepal

Dr. Norge W. Jerome, Director, Office of Nutrition, Bureau for Science and Technology, U.S. Agency for International Development

Dr. Abraham Horwitz, IVACG Chairman

Mr. Kelly Kammerer, U.S. Agency for International Development, Mission to Nepal

General Rabi Shamsher J.B. Rana, Chairman, Nepal Netra Jyoti Sangh

Dr. Aung Myat, World Health Organization, Nepal

Dr. Lay Maung, UNICEF, Nepal

Dr. Carl Kupfer, National Eye Institute, National Institutes of Health, USA

1200-1400 Transportation to the Bluestar Hotel and lunch break

1315-1400 **Registration for National Symposium and XIII IVACG Meeting,** Bluestar Hotel

National Symposium: Overview and Update of the Global Vitamin A Problem

1400-1415 Opening remarks, Bluestar Hotel
Co-chairperson: Dr. R.P. Pokhrel
Co-chairperson: Dr. Abraham Horwitz

1415-1445 Global Dimensions of Vitamin A Deficiency
Dr. Demissie Habte

1445-1515 Newer Aspects of Vitamin A Metabolism
Dr. James Olson

1515-1530 Questions

1530-1600 Break

1600-1630 Newer Aspects of Assessment of Vitamin A Nutriture
Dr. Alfred Sommer

1630-1700 Intervention Strategies and Long-term Solutions in the Prevention and Control of Vitamin A Deficiency
Dr. Barbara A. Underwood

1700-1730 Questions and announcements

Evening Program

1800-1830 Transportation from the Bluestar Hotel to the Royal Academy Hall

1900-2000 Cultural Presentation at the Royal Academy Hall

2000-2030 Reception at the Royal Academy Hall
Sponsored by the Local Committee for the National Symposium and XIII IVACG Meeting

2030-2130 Buffet Dinner at the Royal Academy Hall

2130-2200 Transportation to hotels

Monday, 6 November 1989: National Symposium: Vitamin A Deficiency and Prevention in Nepal: Building a National Strategy

0900-0915 Opening Remarks
Dr. Ram Prasad Pokhrel

Session 1 Defining the Public Health Importance of Vitamin A Deficiency
0915-1045 Chairperson: Dr. Harka Bahadur Gurung

0915-0930 The WHO Prevention of Blindness Survey
Dr. Om K. Malla

0930-0945 The Tribhuvan University Xerophthalmia Survey
Prof. Madan P. Upadhyay

Vitamin A Status and Intake in Nepal: Update 1989

0945-0955 Vitamin A Deficiency in Southeast Nepal
Dr. Sachet P. Shrestha

0955-1005 Xerophthalmia in Sarlahi District (East-Central Tarai): Preliminary Data
Dr. Subarna K. Khatry

1005-1015 Vitamin A Status in the Central Tarai: Preliminary Data
Dr. Bhagbat P. Nepal

1015-1025 The Jumla Xerophthalmia Survey (Mountains)
Mr. Eric Starbuck

1025-1035 Dietary Influence on Vitamin A Intake Among Mothers and Children of the Hills/Mountains of Nepal
Dr. Madhav Gautam

1035-1050 Discussion and Summary

1050-1110 Break

Session 2 Vitamin A Intervention Strategies for Nepal
1110-1225 Chairperson: Dr. T.N. Uppreti

1110-1120 Vitamin A Deficiency Control Through Education
Mr. Dhrub Shrestha

1120-1130 Nutrition Behavior: A Study in Chitwan
Dr. Shashi M. Shrestha

1130-1140 Vitamin A Nutrition and Public Health Education
Dr. Shambhoo P. Lakhey and Dr. K.P. Adhikari

1140-1150 Carotene Content of Some Prominent Food Plants of Nepal
Mr. Yogesh Vaidya

1150-1200 Potential for Fortification: A Consultant Feasibility Study
Mr. Elliot Marseille

1200-1210 Control of Vitamin A Deficiency and Xerophthalmia within the Context of Nutrition Intervention Strategy
Dr. Sudip K. Bhattrai

1210-1225 Discussion and Summary

1225-1400 Lunch

Session 3 Reports of Vitamin A Programs in Nepal
1400-1505 Chairperson: Professor R.P. Pokhrel

1400-1410 SEVA: Vitamin A Deficiency Prevention Through Primary Eye Care Volunteers
Dr. Ram Prasad Koirala

1410-1420 United Kingdom Save the Children Fund: Vitamin A Deficiency and Its Prevention in Surkhet (Hills)
Dr. Terry Matthews

1420-1430 Helen Keller International: Integration of Vitamin A Distribution Within a Rehabilitation Program
Mr. Joel Harary

1430-1440 Freedom From Hunger Foundation: A Vitamin A Kitchen Gardens Program
Mr. Govinda Chitrakar

1440-1450 UNICEF: Vitamin A Support Program in Nepal
Dr. Lay Maung

1450-1505 Discussion and Summary

Session 4 Vitamin A Research Agenda in Nepal
1510-1645 Chairperson: Dr. M.R. Pandey

Double-masked, Community Trial to Assess Efficacy of Vitamin A in Reducing Childhood Mortality in Nepal (The Nepal Nutrition Intervention Project - Sarlahi: "NNIPS")

1510-1520 Goals, Design, and Method of NNIPS
Mr. Sharada Ram Shrestha

1520-1530 Quality Control Procedures of NNIPS
Mr. Uddhab Khadka

1530-1540 Treatment Group Comparability at Baseline: Preliminary Findings
Dr. Keith West

1540-1600 Break

Cost-Effectiveness of Different Practical Approaches to Preventing Vitamin A Deficiency (Nepal Vitamin A Child Survival Project)

1600-1615 Program Design and Basic Findings
Dr. Gopal P. Pokhrel

1615-1630 Vitamin A Deficiency Control Interventions and Their Implementation
Dr. Chet R. Pant

1630-1645 Summary and Discussion

1645-1700 Closing Remarks
Dr. M.R. Pandey

Tuesday, 7 November 1989: IVACG Meeting, Bluestar Hotel

0815-0830 Opening of IVACG Meeting
Dr. Abraham Horwitz, IVACG Chairman

Dr. Norge W. Jerome, Director, Office of Nutrition, Bureau for Science and Technology, U.S. Agency for International Development

Session 1 Vitamin A in Morbidity and Mortality of Young Children
Chairperson: Dr. Abraham Horwitz

0830-0900 Historical Perspective
Dr. Alfred Sommer

0900-0930 Current Perspective
Dr. Ranjit Chandra

0930-1000 Effect of Periodic High Dose on Morbidity and Mortality in Preschool Indian Children
Dr. K. Vijayaraghavan

1000-1030 Effect on Morbidity of a Continuous Modest Improved Intake of Vitamin A in Indian Children
Dr. Laxmi Rahmathullah

1030-1045 Discussion

1045-1115 Break

Session 2 Vitamin A in Morbidity and Mortality of Young Children: Africa
Chairperson: Dr. Florentino Solon

(The following will be 10 minute presentations with 5 minute discussions.)

1115-1130 VAST Design and Logistic Issues: The Methodology of the Ghana Vitamin A Supplementation Trial on Childhood Mortality
Dr. David Ross

1130-1145 Vitamin A Supplementation of Asymptomatic Children, Effects on Morbidity and Mortality in Sudan
Dr. Kamal Ahmed Mohamed and Dr. Alawia El Amin

1145-1200 A Controlled Trial of Vitamin A on Mortality in Ethiopia
Dr. Hagos Beyene

1200-1330 Lunch

Session 3 Vitamin A in Morbidity and Mortality of Young Children: Asia
Chairperson: Dr. Vinodini Reddy

(The following will be 10 minute presentations with 5 minute discussions.)

1330-1345 The Impact of High-Dose Vitamin A on Morbidity Due to Measles Associated Pneumonia: A Double-Blind Randomized Controlled Trial in Philippines
Dr. Marilla G. Lucero

1345-1400 The Effect of Vitamin A Prophylaxis on Morbidity and Mortality Among Children in Urban Slums in Bombay
Dr. Gopa Kothari

1400-1415 The Impact of Mega Vitamin A Dosing with and without Anthelmintic Therapy on the Vitamin A and Morbidity Profile of Underprivileged School Boys in Baroda India
Dr. Tara Gopaldas

1415-1430 Mild Vitamin A Deficiency and Risk of Respiratory Infection and Diarrhea in Preschool and School Children in Northeast Thailand
Dr. Martin Bloem

1430-1445 The Impact of Vitamin A Intervention on Preschool Child and Infant Mortality in Indonesia
Dr. Muhilal

1445-1500 Effect of Single Dose VAC on Breastmilk and Morbidity in Mothers of Low Socio-Economic Status in Bangladesh
Dr. S.K. Roy

1500-1530 Break

1530-1545 Immune Status in Children with Mild Vitamin A Deficiency in Indonesia
Dr. Richard Semba

1545-1600 Immune Status of Children with Mild Vitamin A Deficiency in India
Dr. P. Bhaskaram

1600-1645 Summary and Programmatic Implications
Dr. Jon Rohde

Discussant:
Dr. Saroj Pachauri

1645-1745 **Poster Session A: Morbidity and Mortality Projects**
(set up poster sessions 1300-1330, break down poster sessions 1745-1815)

Optional presentations for projects discussed earlier in the day
(See poster session schedule for list of presenters)

Vitamin A Deficiency in Acute Febrile Malaria Infection in Children
Dr. Olivier Amedee-Manesme

Impact of Oral Vitamin A Supplementation on the Morbidity of Diarrheal and Acute Respiratory Diseases in Breast-fed Bangladeshi Children
Dr. P.K. Bardhan

Investigation of the Therapeutic Efficacy of Vitamin A for Childhood Diarrhea
Dr. Beth Henning

Assessing the Impact of Vitamin A Supplementation on the Incidence and Duration of Episodes of Morbidity Among Children Aged 6 to 47 Months
Dr. Chris Kjolhede

A Survey on the Prevalence of Vitamin A Deficiency in Children of the Slums of Karachi
Dr. Ayesha Molla

1900-2100 IVACG Reception, Bluestar Hotel

Wednesday, 8 November 1989: IVACG Meeting, Bluestar Hotel

Session 4 New Assessment Techniques
Chairperson: Dr. Olivier Amedee-Manesme

0830-0900 Transfer Technique versus the Non-Transfer Technique for Conjunctival Impression Cytology
Dr. Olivier Amedee-Manesme

(The following will be 10 minute presentations with 5 minute discussions)

0900-0920 Disc Applicator for Assessing Vitamin A Status by Conjunctival Impression Cytology
Dr. Deborah Keenum

0920-0940 Use of the Impression Cytology Method with Transfer During a Prevalence Survey on Vitamin A Deficiency in Malawi in 1988: Interest of the Method and Relations with Morbidity and Energy Nutrient Malnutrition
Dr. Alain Jean Escoute

0940-1000 Vitamin A Deficiency Field Screening by Conjunctival Imprint Cytology: A Study of Technology Transfer
Dr. Evangeline Olivar-Santos

1000-1030 Break

1030-1045 Assessment of Marginal Vitamin A Deficiency in Thai School Children by Impression Cytology, Dark Adaptometry and Serum Retinol
Dr. Emorn Udomkesmalee

1045-1100 Conjunctival Impression Cytology: Comparison to Biochemical Measures and Response to Therapy
Dr. Chris Kjolhede

1100-1115 Rapid Appraisal of Community Vitamin A Status Through School Children In Zambia: A Comparison of Assessment Approaches
Dr. David Mwandu

1115-1130 Biochemical Assessment of Vitamin A Deficiency: Serum Distribution Curves Relative to the RDR Test Before and 30 Days After High Dose Supplementation
Dr. Hernando Flores

1130-1145 New Methods for the Assessment of Vitamin A Status
Dr. James Olson

1145-1215 Discussion

1215-1400 Lunch

Session 5 Strategic Considerations for Applied Programs
Chairperson: Dr. Benny A. Kodyat

1400-1430 Management of Community Based Intervention Programs
Mr. R.D. Thulasiraj

1430-1445 Practical Experience in the Use of the Calibrated Plastic Dispensers in the Field
Mr. Raheem Rahmathullah

1445-1515 Tolerance of Preschoolers to Two Dosage Strengths of Vitamin A Preparation
Dr. Rodolfo Florentino

1515-1530 Under What Conditions are Vitamin A Deficiency Control Programs Competitive with Other Child Survival Strategies? Experience in Indonesia
Dr. Robert Tilden

1530-1600 Break

1600-1630 Control of Vitamin A Deficiency and Xerophthalmia in Vietnam
Dr. Ha Huy Khoi

1630-1645 Update on the Experiences and Applications of *Guidelines for the Development of a Simplified Dietary Assessment to Identify Groups at Risk for Inadequate Intake of Vitamin A*
Dr. Luthfor Ahmed

1645-1700 Horticultural Approach: The FAO Vitamin A Regional Network
Ms. Teresa Calderon

1700-1715 Home Gardens as a Practical Measure to Combat Vitamin A Deficiency
Dr. Y.H. Yang

1715-1745 Discussion of Future Directions for Intervention Programs

1745-1915 **Poster Session B: New Assessment Techniques**
(set up poster sessions 1330-1400, break down poster sessions 1915-1945)

Optional posters for studies described earlier in the day
(See poster session schedule for list of presenters)

Detection of Vitamin A Deficiency by Ocular Impression Cytology
Dr. Tahmeed Ahmed

Loss of Vitamin A from Green Leafy Vegetables in Traditional Cooking Methods Among the Poor Families in Bangladesh
Dr. M. Mujibur Rahman

Family Food Production as a Nutrition Intervention Strategy: Some Lessons from the Pacific Islands
Mr. Paul Sommers

Vitamin A and Proteins in Tear Fluid
Dr. Eric J. Van Agtmaal

Adaptation of *Guidelines for the Development of a Simplified Dietary Assessment to Identify Groups at Risk for Inadequate Intake of Vitamin A*
Mrs. Kala Ranasamy

Thursday, 9 November 1989: IVACG Meeting, Bluestar Hotel

Session 6 Country Reports
Chairperson: Dr. Alawia El Amin

0900-0910 Thailand
Dr. Sakorn Dhanamitta

0910-0920 Bangladesh
Ms. Flora Sibanda

0920-0930 India
Dr. Vinodini Reddy

0930-0940 Indonesia
Dr. Benny A. Kodyat

0940-0950 Philippines
Dr. Manuel G. Roxas

0950-1000 African Regional Report for French-speaking West Africa
Dr. Joseph Diallo

1000-1010 African Regional Report for Northeastern Africa, Ghana, and Nigeria
Dr. Demissie Habte

1010-1020 African Regional Report for South and Central Africa
Dr. Moses Chirambo

1020-1050 Break

1050-1100 Brazil
Dr. Hernando Flores

1100-1110 Myanmar
Dr. Moe Moe Sunn

1110-1120 Western Pacific Islands
Dr. Michelle Puryear or Dr. Keith West

1120-1230 **Poster Session C: Country Reports**
(set up poster sessions 0830-0900, break down poster sessions 1230-1300)
(See poster session schedule for list of presenters)

1230-1400 Lunch

Session 7 Agency Reports
Chairperson: Mr. Anish Barua

1400-1410 Food and Agricultural Organization of the United Nations (FAO)
Ms. Teresa Calderon

1410-1420 United Nations Childrens Fund (UNICEF)
Dr. V. Ramalingaswami

1420-1430 World Health Organization
Dr. Graeme A. Clugston

1430-1440 U.S. Agency for International Development
Dr. Norge W. Jerome

1440-1450 National Eye Institute, National Institutes of Health, USA
Dr. Barbara A. Underwood

1450-1500 International Development Research Center (IDRC)
Ms. Jenny Cervinskas

1500-1510 Ford Foundation
Dr. Saroj Pachauri

1510-1630 **Poster Session D: Agencies and Nongovernmental Organizations**
(set up poster sessions 1330-1400, break down poster sessions 1630-1700)

Optional posters for agency and nongovernmental organization representatives
(See poster session schedule for list of presenters)

Vitamin A Deficiency in Micronesia: Magnitude and Risk Factors
Dr. Michelle Lloyd Puryear

Vitamin A Delivery Through an Inhalative Route
Dr. H.K. Biesalski

Rice Powder Oral Rehydration Solution (ORS) and Food For Children with Diarrhea
Ms. M.E. Krantz

1800-1930 Vitamin A Technical Assistance Program of Helen Keller International Reception, Bluestar Hotel

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Friday, 10 November 1989: IVACG Meeting, Bluestar Hotel

Session 8 Nongovernmental Organization Reports
Chairperson: Ms. Susan Eastman

0900-0910 Task Force SIGHT AND LIFE
Dr. John Gmunder

0910-0920 Helen Keller International: Vitamin A Technical Assistance Program
Ms. Susan Eastman

0920-0930 Catholic Relief Services
Mr. Richard Renas

0930-0940 Nepal Netra Jyoti Sangh
Dr. R.P. Pokhrel

0940-0950 Cristoffel Blindenmission
Dr. Allen Foster

0950-1000 Royal Commonwealth Society for the Blind
Dr. Gopa Kothari

1000-1010 International Eye Foundation
Dr. Larry Schwab

1010-1025 **Official XIII IVACG Meeting Photograph Session**

1025-1045 Break

1045-1050 IVACG Secretariat Report
Dr. Timothy A. Morck

1050-1100 **Closing Remarks**
Dr. Abraham Horwitz, IVACG Chairperson

Lunch

Departure for Site Visits

National Symposium and XIII IVACG Meeting Poster Session Schedule

Tuesday, 7 November: Poster Session A
Morbidity and Mortality Projects

Presenters at posters: 1645-1745
Set up: 1300-1330 Take down: 1745-1815

Dr. David Ross
Dr. Alawia ElAmin
Dr. Gopa Kothari
Dr. Tara Gopaldas
Dr. S.K. Roy
Dr. Olivier Amedee-Manesme
Dr. P.K. Bardhan
Dr. Beth Henning
Dr. Chris Kjolhede
Dr. Ayesha Molla

Wednesday, 8 November: Poster Session B - New Assessment Techniques

Presenters at posters: 1745-1915
Set up: 1330-1400 Take down: 1915-1945

Dr. Emorn Udomkesmalee
Dr. David Mwandu
Dr. Luthfor Ahmed
Dr. Y.H. Yang
Dr. Tahmeed Ahmed
Dr. M. Mujibur Rahman
Mr. Paul Sommers
Dr. Eric J. Van Agtmaal
Mrs. Kala Ranasamy

Thursday, 9 November: Poster Session C
Country Reports

Presenters at posters: 1120-1230
Set up: 0830-9000 Take down: 1230-1300

Dr. Sakorn Dhanamitta
HKI Indonesia
Dr. Ha Huy Khoi

Thursday, 9 November: Poster Session D
Agencies and Nongovernmental Organizations

Presenters at posters: 1500-1630
Set up: 1330-1400 Take down: 1630-1700

Ms. Teresa Calderon
Dr. H.K. Biesalski
Dr. R.P. Pokhrel
Ms. M.E. Krantz
Nepal Netra Jyoti Sangh

Abstracts

National Symposium

and

XIII IVACG Meeting

XEROPHTHALMIA AMONG NEPALESE CHILDREN[1], Madan P. Upadhyay (Tribhūvan University Institute of Medicine, Post Box 2162, Maharajgunj, Kathmandu, Nepal), Bhupendra J. Gurung, K. Kesava Pillai and Bhagawat P. Nepal.

A nationwide sample survey was conducted between July 1980 and June 1981 to determine the prevalence of xerophthalmia among Nepalese children. Population proportionate random samples were drawn from the 12 geopolitical subdivisions of the country by employing multistage sampling technique. The survey population was defined as the child population of rural Nepal between the ages of 0 and 14 years. The per cent prevalence of xerophthalmia in Nepal was 1.65 for Bitot's spots, 0.02 for corneal ulcer, and 0.03 for corneal scar. While cases of Bitot's spots were more prevalent in the plains of Nepal, followed by the mountains and the hills, the reverse was true for corneal lesions. Vitamin A deficiency was found to be responsible for one-third of acquired bilateral blindness in preschool children. All corneal cases in the study were accompanied by diarrhea and malnutrition, indicating xerophthalmia to be symptomatic of the whole spectrum of malnutrition.

VITAMIN A DEFICIENCY IN SOUTH-EAST NEPAL. Dr. Albrecht Hennig, Ophthalmologist, Lahan Eye Hospital, Nepal; Dr. Allen Foster, Senior Lecturer, Institute of Ophthalmology, London; Dr. Ram Prasad Pokhrel, Manager, Prevention of Blindness Programme, Kathmandu, Nepal; and Dr. Sachet Prabhat Shrestha, Ophthalmologist, Lahan Eye Hospital, Nepal.

A retrospective review of the outpatient records of 4,601 children (0-10 years) seen at Lahan Eye Hospital in South-East Nepal between January 1986 and December 1988 revealed that 16.9% (776) had evidence of active or previous xerophthalmia.

49% of 293 children with corneal xerosis (X2) or corneal ulcer (X3) were seen between the months of May and August.

The peak age for active non-corneal xerophthalmia (X1a + X1b) was 5 years and active corneal xerophthalmia (X2 or X3) 3 years.

85% of children with X3 gave a preceding history of diarrhoea. 52% of children with X3 came from Siraha or Saptair districts.

DIETARY INFLUENCE ON VITAMIN A INTAKE AMONG MOTHERS AND CHILDREN OF THE HILLS/MOUNTAINS OF NEPAL, Madhav Gautam, GPO 1440 APROSC, Kathmandu, Nepal

Vitamin A deficiency and xerophthalmia is a well identified public health problem, and it is a leading cause of blindness among pre-school children in Nepal. Xerophthalmia is present in most of areas of the country, however, it is concentrated largely in the Terai. High dose vitamin A capsule distribution has been a major intervention program in the country.

Data on 200 of age under 15 years children from the eastern to the far-western hills/mountains of 27 sites were analyzed to determine the vitamin A intake from the dietary sources. Food composition tables were used to determine an individual's vitamin A intake from weighed food consumption data.

The tradition of early marriage and pregnancy commonly found in Nepal, may have an influence on the vitamin A status of the mother and intake of the young child. Vitamin A intake from dietary sources was analyzed in a sample of 100 women aged 16-49, living in close geographical proximity. This study was designed to investigate the relationship between maternal and infant vitamin A intake, together with seasonal variation in intakes especially around June/July and January/February.

In addition to animal produce, maize and millet have made a substantial contribution to vitamin A intake. The younger children, however, are not encouraged to eat maize staples and green vegetables. However, the sustainable long-term solution to the problem of an inadequate vitamin A status among the children seems to be possible through the improvement of dietary intake of yellow staple and green vegetables. Improving vitamin A status and xerophthalmia, therefore, means expanding the production of vitamin A rich foods and an increased intake through the attitudinal and behavioral changes among mothers and young children.

NUTRITIONAL BEHAVIOR: A STUDY IN CHITWAN PRELIMINARY FINDINGS, Shashi Maya Shrestha, Program Director, Joint Nutrition Support Program, Kathmandu, Nepal; Suzinne Pak, Research Assistant, Vitamin A Child Survival Project, School of Public Health, University of Michigan, Ann Arbor, Michigan, USA; and The Vitamin "A" Child Survival Project Research Team.

Nepal contains a diversity of ethnic groups and Chitwan provides a small microcosm of all of these ethnic groups. Located in the Terai, Chitwan offers an opportunity to study most of the ethnic groups found in Nepal. Thus, for this small-scale study, Chitwan provided an ideal location for the examination of nutrition behavior, particularly as it pertains to vitamin A-rich foods.

Thirty-two villages from seven panchayats in Chitwan were selected for this small-scale nutrition study. The purpose of this study was to gain an insight into the nutrition behavior and values of the area particularly as they pertained to children's consumption of foods with high vitamin A content. Better understanding of nutrition behavior in the study area will make possible a more appropriate formulation of nutrition messages for the nutrition education programs. The sample covered 466 households which contained a mean of 3 children per household.

Some of the preliminary findings are: wild growing fruits and vegetables (Jungle foods) are major sources of food. Many of these Jungle foods are rich in vitamin A and other micronutrients. Another finding is that there are a substantial number of taboos against serving dark green leafy vegetables (DGLVs) during illness.

Reasons for avoiding fruits and vegetables included beliefs that they would make the child sicker. Another important finding was that 33% of all mothers did not feed their children colostrum. In fact, some mothers waited as long as 4 days before breast feeding at all. Such practices only serve to weaken the child and increase susceptibility to other diseases. The results of this study reveal a great need for further nutrition education.

NUTRITION AND PUBLIC HEALTH EDUCATION, Dr. S.P. Lakhey, Deputy Project Chief, Nepal Prevention and Control of Blindness Project; Dr. K.P. Adhikari, Operation Officer, Health Education Programme, Nepal Netra Jyoti Sangh.

Nepal is a developing country with a very low per capita income. It has an area of 167,181 Sq. Kilometers. Geographically it can be divided into four main regions (1) the Himalaya region, (2) the mountain region, (3) the hill region, and (4) the terai region. All of them stretch from east to west almost parallel to each other. There is hardly any human inhabitation in the Himalayan region. The transport facilities especially in the mountains and the hills are very poor. The total population is 17 million. The literacy rate is 30%. According to the national survey of 1980-1981, there are 118,000 blind people in Nepal and it is nearly equal in USA with 16 times more population.

The mountain and hill regions cover 76.5% of the total area of Nepal. 93% of the Nepalese live in rural areas. The people in rural areas are less aware of balanced diets and malnutrition is a greater problem with them.

The present study will try to find out the present nutritional condition in the population by collecting data of surveys done by different agencies in different parts of the country. It will collect information to assess the knowledge of the people regarding nutrition. It will try to record the extent of malnutrition in children under 5 years. It will try to study the nutrition required for a socially and economically productive life. It will stress the role of nutrition to meet the vitamin A requirement for healthy eyes and the importance of vitamin A for normal epithelial integrity.

The education given to the public should make them nutrition oriented. The rural areas are deprived of ophthalmic services. The blindness caused by malnutrition is preventable, thus the education should help in creating awareness for prevention of malnutrition. The education will help them to know about the easily available things to escape malnutrition.

The eye health program in Nepal under Nepal Netra Jyoti Sangh with collaboration of Nepal Prevention and Control of Blindness Project has started an extensive education program on eye health care through mass and individual approaches. This includes radio programs, print materials (newsletters, posters, flyers, discharge slips, PEC - manuals, etc.). School health education should get priority. Training workshops for school teachers, VH workers, health post staffs and social workers should be arranged. There should be development of audio-visuals, slides and TV programs.

CAROTENE CONTENT OF SOME PROMINENT FOOD PLANTS OF NEPAL, A Profile,

Yogesh Vaidya, Chief, Nutritional Research and Development Division, Central Food Research Laboratory, Kathmandu, Nepal.

The dietary supply of vitamin A activity is almost entirely from plant sources in the developing countries such as Nepal. The ultimate source of natural vitamin A is the carotenoids present in the food plants which make one of the important constituents of the diet. Precursor forms of vitamin A-active carotenoids are widely distributed in dark green leafy vegetables, yellow vegetables, yellow and red fruits. These forms of vitamin A activity are more universally available and cheap sources of vitamin A than animal sources.

Carotenoids are pigments found in yellow, red, orange, and green plants. They are present in all photosynthetic tissues and in some non-photosynthetic tissues such as roots, flowers, fruits, seeds and vegetables.

Small food consumption surveys carried out in different parts of the country with different purposes indicate that the Nepalese diet of the majority of the rural poor is monotonous and deficient in vegetables. Dark green vegetables are seldom given to young children. Also in hill areas where water is scarce and rain-dependent, availability is only seasonal.

The long-term solution to the vitamin A deficiency problem is to increase the production and consumption of carotene-rich food plants. The botanical intervention of promotion of home gardens is most suitable in our situation.

Although a small country, Nepal is gifted with the diversity of geo-physico-climatic conditions which contribute to rich vegetational environment and resources of indigenous food plants which are found in different conditions - cultivated, semi-domesticated and wild. All these contribute to the diet of the people in different seasons.

Knowledge of nutrient content of foods is essential for many types of nutritional studies, planning and interventions. But appropriate nutrient data bases are not always readily available for these activities. Since a long-term vitamin A programme has to have a thrust on promotion of carotene-rich food plant sources, it is imperative that both cultivated and wild food plants be studied for their carotene content, their identification and seasonal contribution in the diet of the local people.

It is with this objective that some of the common vegetables such as Spinach, Garden cress, Fenu-greek, Rape leaves, Cabbage, Lettuce, Carrots, Pumpkin, Apricot, etc. as well as some wild and seasonal vegetables such as Water cress, Amaranths, Edible ferns, Stinging Nettle, Pigweed, Lamb's Quarter, Colocasia, Curli Doek, Prostrate-yarba-de-Tega, Garlic pear, Drum stick, Wing beans, Karvo, Buckwheat leaves, Common Mint, etc. have been analyzed for the beta-carotene content under existing laboratory facilities in Central Food Research Laboratory. AOAC and HPLC Analytical Methods have been used. Not considering the crudeness or the sophistication of the two analytical methods and their accuracy, the resulting data are compared to identify food plants of moderate and high beta-carotene content. The comparison shows that seasonally available wild or semi-domesticated food plants which are also poor men's vegetables are highly rich sources of beta-carotene.

Long-term interventions must consider the importance of these underexploited food plants of Nepal for their increased utility through demonstration and domestication.

Control of Vitamin A Deficiency and Xerophthalmia within the context of Nutrition Intervention Strategy

Dr. S.K. Bhattarai
Chief, Nutrition Section
Ministry of Health

ABSTRACT

The paper outlines the problem of malnutrition, micronutrient deficiencies and infection in the country. It then summarise the development of National Nutrition strategy within the overall development of the country. The implication of the National Nutrition Strategy in the prevention and control of vitamin A deficiency is presented with special reference to sectoral strategies and intervention. In this context the present control measures will be reviewed. Similarly the problems and constraints in implementation of Nutrition program, in particular of vitamin A deficiency control will be discussed.

ABSTRACT

Vitamin A deficiency and its Prevention in Surkhet district

Dr.Terence K.Matthews MB ChB, MRCGP, DTM&H (Liverpool)

Project Coordinator, Save the Children Fund (UK) Surkhet Project,

P.O.Box 992, Kathmandu, Nepal

Three clinic-based surveys and one community-based survey looking at the prevalence of vitamin A deficiency in children under 10 and 5 years of age respectively performed between 1985 and 1987 are described.Following the first clinic survey, the impact of a clinic-based vitamin A prophylaxis programme is assessed by further clinic based studies controlled for season.All examinations were performed by paramedical workers.

Over the 2 year programme period, a sustained fall in the prevalence of night blindness was found in the 1 to 4 and 5 to 10 year age groups (from 2.4 % to 0.5 % in the under 5's, and 7.2 % to 2.8 % in the 5 to 10 year old group) .The prevalence of eye signs showed a fall in the infant group but a sustained decrease was not noted in children over one year old.

The community survey found a prevalence of night blindness of 1% and of eye signs of xerophthalmia also of 1% ; thus vitamin A deficiency was confirmed to be a significant public health problem (by WHO criteria) in a district of the middle hills of Nepal.

GOALS, DESIGN AND METHODS OF NEPAL NUTRITION INTERVENTION PROJECT - SARLAHI (NNIPS). S.R. Shrestha, S.K. Khatry, K.P. West, Jr., S.C. LeClerq, R.P. Pokhrel, A. Sommer.

NNIPS is a controlled, double-masked community trial being carried out in the rural Terai of Nepal to evaluate the impact of vitamin A supplementation on child health and survival. The research goals of NNIPS are to assess the impact of large-dose vitamin A capsule delivery (i.e., 200,000 IU) every 4 months in reducing preschool child mortality and morbidity, and in improving growth of children who are below 5 years of age at the time of enrollment. The design and sample size of the study have been guided by the goal of evaluating the impact of vitamin A on mortality.

Sarlahi was chosen because of its anticipated, high level of vitamin A deficiency, its population density and relative access, the enthusiasm for the project among local leaders and because of its geographic and cultural similarity to the Gangetic flood plain communities of South Asia. 29 Panchayats - each consisting of 9 administrative wards - were selected for study. Information about the trial was distributed, community meetings were held and permission to work in the community obtained from all panchayat leaders prior to mapping and numbering the approximate 33,000 households in these 261 wards. We expect a total baseline enrollment of 30 to 34,000 children below 5 years of age. This number will be sufficient to detect a 25% reduction in under 5 mortality over 20 months of intervention and follow-up, or - from an estimate of 25 to approximately 18 child deaths per 1000, with 95% confidence and a 90% probability of showing such an effect if it is truly there. The final sample size was derived by adjusting estimates upward by 30% to account for clustering of mortality that may exist at the ward level and another 10% to account for out migration and other potential losses to follow-up.

There are two dosages of vitamin A being distributed: 200,000 IU and 1000 IU of vitamin A, both also containing 40 IU of vitamin E. There are about 15 to 17,000 children in each of the high and low dose groups. The capsules were developed and donated by Task Force SIGHT AND LIFE. Physical attributes of the coded capsules are identical to the standard UNICEF vitamin A capsule, and to each other, except for their vitamin A content. During house-to-house visits, children 1 to 4 years of age receive the entire contents of the capsule. Infants 1 to 11 months of age receive 1/2 of a capsule - or 6 drops - and infants below 1 month receive 1/3 of a capsule - or 3 drops.

Participating wards will be visited 6 times, every 4 months, for a total of 20 months of supplementation and follow-up. At each visit, all households are visited by 1 of 5 trained teams of interviewers, children are censused and dosed according to their code, and a history of common morbidities during each of the previous 7 days are obtained at each of the 6 visits. Morbidity data are being recorded as the number of days a child has been sick during the past week.

Mid-upper arm circumference is being measured on all children at visit 1 to assess baseline wasting nutritional status and to adjust the effect of vitamin A on mortality. A history of preschool deaths during the previous year and a cumulative maternal history of births and deaths are obtained at the time of entry into the trial - mostly at visit 1 - using the "Bras Technique." Household socioeconomic, hygiene and demographic factors will be assessed at the second 4-monthly visit.

About 4500 children in a random subset of 40 wards are being evaluated for ocular status and more in-depth nutritional assessment. These wards receive all of the dosing and morbidity history procedures that standard wards receive at each visit. Children are also examined by an ophthalmologist and a subsample receives impression cytology at baseline and at the final follow-up visit. Nutritional assessment includes weight, height and mid-upper arm circumference at each visit and skinfold measurement at the triceps and subscapular sites at visits 1 and 6. This subsample will also receive a standard household assessment at visit 2 and is scheduled for dietary assessment at either visits 3 or 4. Blood may be drawn for serum vitamin A and hemoglobin analyses from a small subsample of these children at a later follow-up visit.

Independently of the 4-monthly household visits, bi-monthly ward surveillance for child deaths is starting in November 1989. Verbal autopsy interviews will be carried out to ascertain causes of mortality, usually within 2-3 months of a child's reported date of death.

This field trial began on September 18, 1989 and field work is due to continue until September 1991.

QUALITY ASSURANCE OF DATA FOR A LARGE VITAMIN A COMMUNITY TRIAL IN RURAL NEPAL. U. Khadka, E.K. Pradhan, J. Canner, J. Katz. Nepal Nutrition Intervention Project, Sarlahi, Kathmandu, Nepal.

Carrying out a 30,000-Child community trail to assess the impact of vitamin A on reducing childhood mortality in a remote area of rural Nepal provides many challenges to maintain integrity of the data. Initial concerns include (1) careful staff interview and selection procedures, (2) design and testing of questionnaires and data collection forms for cultural and linguistic validity, (3) data entry programming that meets the exacting and unique demands of the study, (4) development of training manuals, and training and standardizing field teams and data processing staff to minimize error at the outset.

Thereafter, minimizing error throughout the trail depends on rigorous supervision, periodic retraining and enforcement of a systematic series of "checks and balances" from the point of data collection and dosing of children through the forms editing process to computerized data entry. The current vitamin A intervention mortality trial in Nepal is being carried out in Sarlahi district in the East-Central Terai. The series of checks and balances being undertaken by the trial to ensure the highest level of data quality are described. The major goal of this quality assurance protocol is to limit human error such that the community and its response to vitamin A supplementation are described as accurately and reliably as permitted by the design of the study.

XEROPHTHALMIA IN SARLAHI DISTRICT: PRELIMINARY BASELINE DATA. S.K. Khatry, R.P. Pokhrel, M.D. Thapa, K.P. West, Jr. Nepal Nutrition Intervention Project, Sarlahi. Kathmandu, Nepal.

A randomized, double-masked community trial to assess the impact of vitamin A on reducing preschool child mortality was launched in the East-Central Terai District of Sarlahi in September 1989. A baseline ocular survey is underway in a 15% random subsample of the participating 270 wards (n=40 wards, 4200 children) to 1) measure the prevalence of xerophthalmia in the study area, 2) assess the comparability of intervention and control groups in their vitamin A status at the outset of the trial, and 3) to provide baseline data against which to assess efficacy of vitamin A in reducing xerophthalmia at the end of the study. Children are being examined for xerophthalmia by a fully trained and experienced ophthalmologist and senior ophthalmic assistant employing standard methods of classification. All cases plus a 25% systematic subsample of all children 2-4 years of age are further being assessed for vitamin A status by conjunctival impression cytology (CIC-A). Preliminary data on the prevalence of xerophthalmia in this northern-most Gangetic flood plain area will be presented.

VITAMIN A REGULATION OF IMMUNOCOMPETENCE AND RISK OF INFECTION

Ranjit Kumar Chandra MD FRCPC PhD DSc(Hon)

Although vitamin A has been known as the anti-infective vitamin for decades, definitive work establishing its critical role in modulation of immune responses and outcome following infectious challenge is relatively recent. The presentation will focus on five areas. One, the cellular and molecular basis of interactions of vitamin A and immune system, based largely on in vitro work. Two, animal work where depletion-repletion experiments have shown the important influence of vitamin A on cell-mediated immunity, complement system, cell traffic and natural killer cells. Three, the effect of vitamin A supplements on immune responses and outcome after challenge with a variety of microorganisms. Four, human studies where vitamin A deficient subjects have been observed and how their immune responses are altered, before and after attempts at correction of the deficient state. Five, the effects of moderate and large suplements of beta-carotene and vitamin A over short and long term on immune responses. Finally, the practical applications of these observations will be highlighted.

VITAMIN A DEFICIENCY AND MORBIDITY IN PRESCHOOL CHILDREN, Dr. K. Vijayaraghavan, Dr. K.V. Rameswara Sarma, Dr. N. Pralhad Rao and Dr. Vinodini Reddy. National Institute of Nutrition, Hyderabad-500007, India.

Vitamin A deficiency is a major public health problem in India, contributing to a considerable proportion of blindness in young children. Recent studies reported from Indonesia suggest that vitamin A deficiency is also associated with increased risk of respiratory and diarrhoeal diseases. A study was therefore undertaken by the National Institute of Nutrition to investigate the relationship between vitamin A deficiency and morbidity and also to assess the impact of vitamin A supplementation on morbidity in children living in rural areas around Hyderabad.

The study was carried out in 5 Primary Health Centres covering about 17,000 preschool children. All the households of preschool children were visited by the field investigators once in 3 months for collection of morbidity data during the previous month. A clinical examination was conducted by medical officers once in 6 months for the assessment of nutritional status. After the baseline survey, the villages were randomly allocated into two equal groups. One group (experimental) of preschool children received massive dose of 200,000 I.U. vitamin A once in 6 months, while the other group (control) received placebo.

Results of the study showed that children with xerophthalmia had higher prevalence of respiratory infection as compared to those with normal eyes. There was no such association with diarrhoea. There was no significant difference in the morbidity rates between control and experimental groups after the intervention programme was started. Mortality rates of children in the study areas were lower than the national average, but did not differ significantly between experimental and control groups. Further data analysis is underway to determine the effect of vitamin A on child survival.

EFFECT ON MORBIDITY OF A MODEST IMPROVED INTAKE OF VITAMIN A

Dr. (Mrs) Laxmi Rahmathullah, Director, Child Development Services, Royal Commonwealth Society for the Blind, Aravind Children's Hospital, Madurai 625 020; Dr. Barbara A. Underwood, National Eye Institute, NIH, USA; Mr. Thulasiraj D. Ravilla, Administrator, Aravind Eye Hospital, Madurai.

A double masked study has been undertaken by the Aravind Eye Hospital in collaboration with the Royal Commonwealth Society for the Blind and the National Eye Institute with funding from Ford Foundation, India. The study is being conducted in Trichy District, Tamil Nadu, South India among children 6-60 months of age. The objectives of the study are: 1) to determine the effect of an adequate intake of vitamin A (the equivalent of at least the RDA) on morbidity, particularly on the incidence and duration of diarrhoea and lower respiratory infections, and 2) to record the effect of an adequate intake of vitamin A on mortality trends.

The study includes over 15,500 children who have been assigned randomly to one of two groups. On a weekly schedule one group receives a solution containing approximately 8000 IU vitamin A and 20 mg vitamin E in 1 ml peanut oil delivered from a precalibrated color coded plastic dispenser directly into the child's mouth. The other group receives only 20 mg vitamin E in 1 ml peanut oil from a similar color coded dispenser. Both solutions are identical in appearance. The solutions and dispenser bottles were supplied through the Sight and Life Program and the manufacturer independently holds the code.

Criteria for selection of the study sites were based on proximity to Madurai, agriculturally backward, predominantly poor socio-economically and without significant specific child care programmes. The Panchayat Unions finally selected were Aravakurichy, Kadavur and part of Krishnarayapuram. Each Panchayat Union is composed of a number of Panchayats (villages) which, in turn, are composed of hamlets of varied sizes.

The areas were mapped and the populations enumerated. A socio-economic survey was done on all households with children under 5 years of age. A 5 year truncated child mortality history was obtained from all women 15-44 years of age. A baseline medical, ocular and anthropometric survey was completed on all children 6-60 months of age in the study areas selected.

Hamlets were grouped to form a cluster of 50-80 children. Each cluster was assigned to a community health visitor (CHV). Hamlets with one or two children were included in the clustering as they could be among the most deprived of the population. After clustering, a 20% sample of the base line medical data was randomly extracted to provide the basis for checking the validity of the baseline randomization. By systematic sampling, a 2% subsample of children were subjected to drawing of blood for baseline serum vitamin A levels and for a dietary assessment using the IVACG guidelines.

Intervention with the solutions started the end of July '88 and will be completed 1 August '89. A repeat ocular survey will be conducted mid-term and a complete medical, anthropometric and ocular survey will be repeated at the end of the one year intervention period.

At the time the solution is given weekly, the CHV obtains a morbidity record on recall for the preceding week. Information is recorded on the type and number of stools, and, for respiratory infections, on precoded symptoms and lung involvement for each day of the preceding week. Other morbidities like CSOM, scabies, measles, chicken pox, worm infestation, hepatitis and others are also recorded.

The morbidity data is entered directly into portable computers and checked for accuracy weekly in the field. The monitoring data available at about the mid-point of the study indicates that 87-91% of the study children are receiving the solutions weekly.

Preliminary results of effects of modest vitamin A supplementation on morbidity will be presented.

ABSTRACT FOR XIII IVACG MEETING

TITLE: VAST DESIGN AND LOGISTIC ISSUES: THE METHODOLOGY OF THE GHANA VITAMIN A SUPPLEMENTATION TRIAL (VAST) ON CHILDHOOD MORTALITY,

AUTHORS: David A Ross(1)
Nicola Dellimore (1) } Ghana VAST, BP 57, Po, Burkina Faso
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The methods being used in the Ghana Vitamin A Supplementation Trial to examine the effects of four-monthly large doses of vitamin A on childhood mortality will be described. The emphasis will be on design and logistic issues, such as the definition of the study population; indications for treatment and exclusion from randomization; choice of the form of the supplement (liquid or capsule); duration of the study; recruitment, training and supervision of the field staff; the design, use and checking of the various questionnaires and other study records, and their local entry, checking and basic analysis at the study site; and ethical issues.

The study is a double-blind, placebo controlled trial of approximately 15000 rural children aged 6-59 months at entry to the trial, who will be followed up every four months for two years. It is a collaborative study between the London School of Hygiene and Tropical Medicine and the University of Science and Technology, Kumasi, Ghana, with the support of the Ministry of Health of Ghana and the British Government. It is being carried out in Kassena-Nankana District, Upper East Region, in the far North of Ghana.

Although the main emphasis will be on methodological issues, the provisional results of the pilot and other preliminary studies will also be presented.

VITAMIN A SUPPLEMENTATION OF ASYMPTOMATIC CHILDREN, EFFECTS ON MORBIDITY AND MORTALITY, Alawia El Amin, Kamal Ahmed Mohamed, Nutrition Division, Ministry of Health, Sudan, Penelope Nestel, M. G. Herrera, Harvard Institute for International Development, 1 Eliot Street, Cambridge, MA 02138, U.S.A.

To ascertain the effects of Vitamin A administration on infectious disease morbidity and mortality, a double blind, randomized trial is being conducted in the Sudan. Baseline socio-demographic, anthropometric, morbidity and dietary intake assessments were used to test the comparability of treatment groups. At the time of the initial survey, preschool children were randomly assigned by household to one of two treatment groups: 1) 200,000 IU Vitamin A and 40 U Vitamin E every six months 2) 40 U Vitamin E every six months. Any child with signs or symptoms of Vitamin A deficiency was treated and excluded from the study. Follow up visits are carried out every 6 months to administer the vitamin capsules and to repeat the morbidity and anthropometric measurements. A sample of approximately 24,000 subjects will be followed for a period of two years. A progress report based on the first six months of observation of approximately 18,000 children will be presented.

THE IMPACT OF HIGH-DOSE VITAMIN A ON MORBIDITY DUE TO MEASLES ASSOCIATED PNEUMONIA: A DOUBLE-BLIND RANDOMIZED CONTROLLED TRIAL, Lucero Marilla G., Gatchalian Salvacion R., Zeta Rose, Sunico Elinor S., Chua Jimmy, Santana Marie, Carlos Celia, Patalod Luz, Saniel Mediadora C., Research Institute for Tropical Medicine, Alabang, Muntinlupa Manila, Philippines.

A double-blind randomized controlled trial of high-dose (200,000 i.u.) and low-dose (2,000 i.u.) Vitamin A was conducted in April 1988 amongst children < 5 years of age admitted for measles associated pneumonia in the Research Institute for Tropical Medicine in the Philippines. The drug was given only once upon admission. The objective of the study was to determine if high-dose Vitamin A would reduce mortality in these patients by 40-50% as was reported in a similar hospital-based study in Tanzania in 1987. Data are still being collected. The codes will not be broken till data analysis sometime in April 1989. Data analysis will be completed by July 1989 when results can be reported.

THE EFFECT OF VITAMIN A PROPHYLAXIS ON MORBIDITY AND MORTALITY AMONG CHILDREN IN URBAN SLUMS, Dr. Gopa Kothari, Dr. Eknath Naik, Mrs. Pushpa Pathak. Department of Community Medicine, L.T.M., Medical College, Sion, Bombay - 400 022 India. Professor and Head Community Medicine Department L.T.M.M. College and Hon. Project Director Prevention of Blinding Malnutrition in Children Bombay Slum Project, Medical Officer Bombay Slum Project and Community Organizer Bombay Slum Project.

Two slum areas in city of Bombay are selected for this research. After initial survey, in one slum six monthly vitamin A prophylaxis is carried out among children below the age of six years and in another slum after collecting the baseline data, no intervention is carried out. The morbidity and mortality data is collected at six monthly intervals in children below six years in both the groups.

In the experimental group the mortality has come down to 3.6/1000 from 16/1000 from 1985 to 1988 among the under five children. There is a decline in respiratory infection, skin diseases, otitis media, malnutrition and diarrhoeal spells. The post measles complications have declined and there are no cases of xerophthalmia in this group. In the control group the mortality has continued to be high and ranges from 18 to 20/1000 among under five children. There is high incidence of respiratory infection, diarrhoeal spells, skin diseases and malnutrition and significantly high incidence of vitamin A deficiency cases.

IMPACT OF MEGA VITAMIN A DOSING ON THE MORBIDITY PROFILE OF UNDER-PRIVILEDGED SCHOOL BOYS (9-15 YRS), Meenakshi Bakshi[1] and Tara Gopaldas[2]
Department of Foods and Nutrition, M.S. University, Baroda, India.
[1]Ph.D. Scholar, [2]Ph.D. Guide and Dean, Faculty of Home Science.

A double blind community based clinical trial was carried out in Baroda city of Gujarat, Western India, to study the impact of mega vitamin A dosing on the morbidity profile of underprivileged school boys. Two hundred and ten children from four primary schools were randomized into Experimental and Control groups after matching for age, vitamin A status, parasitic status and percent prevalence of common childhood morbidities (URI, fever, diarrhoea and helminths/protozoa). The Experimental group of children received 200,000 IU of vitamin A every four months for one year, while the other group was the Placebo Control group. Morbidity profile (prevalence, episodes and days of illness) of each child was recorded every fortnight for one year based on the child's own recall of common morbidities suffered by him in the preceding one week. The investigator physically examined the child on the day morbidity data were collected. Mega vitamin A dosing significantly reduced the occurrence (prevalence), frequency (episodes) and duration (days) of common childhood morbidities (except for diarrhoea) in the Experimental as compared to the Control group. The impact of mega vitamin A dosing was sustained even after controlling for the nutritional status of the children in the Experimental and Control groups. Vitamin A deficiency emerged as a major contributor of increased morbidity in primary school age children. The results of this study suggest that mild and common morbidities in school children (9-15 yrs) can be significantly reduced by mega vitamin A (200,000 IU) dosing, three times a year.

MILD VITAMIN A DEFICIENCY AND RISK OF RESPIRATORY INFECTION AND DIARRHEA IN PRESCHOOL AND SCHOOL CHILDREN IN NORTHEAST THAILAND

Martin W. Bloem, MD, PhD, country director HKI, Gulshan P.O. BOX 6066, Dhaka-1212, Michel Wedel, MSc, Wil H.P. Schreurs, PhD, DSc.P

To investigate the association between mild vitamin A deficiency, as evidenced by serum retinol levels, and the occurrence of diarrhea and respiratory disease, three studies were carried out. A cross-sectional analysis was carried out among 1772 children, aged 1 to 8 years. Children with a history of diarrhea or respiratory disease had significantly lower levels of serum retinol and retinol-binding protein, adjusted for the possible confounding effects of age, sex, nutritional status, protein status, and level of urbanisation. A follow-up study of a subsample of 146 children showed that children with deficient serum retinol levels (<0.35 μmol/L) had an about 4 times greater risk of developing respiratory diseases ($p<0.01$) than had children with adequate levels during a follow-up of three months. A controlled intervention trial with 166 children, aged 1 to 5 years, showed that during two months of follow-up after supplementation with a Vitamin A-capsule, the control group of children aged 3-5 years had a higher incidence of respiratory disease (2.89 times) as well as of diarrhea (3.02 times) than the intervention group. Between two and four months a significantly ($p<0.025$) higher incidence of respiratory disease (2.56 times) could be observed in children aged 1-2 years. This study supports earlier reports on the greater risk of children with mild vitamin A deficiency of developing respiratory diseases and, to a lesser extent, diarrhea.

THE IMPACT OF VITAMIN A INTERVENTION ON PRESCHOOL CHILD AND INFANT MORTALITY, Muhilal and S. Saidin, Nutrition Research and Development Centre, Ministry of Health, Indonesia.

Two control field trials were recently conducted to investigate the impact of vitamin A intervention on child and infant mortality. In the first field trial, fortification of monosodium glutamate (MSG) with vitamin A was carried out in a program area which included 5000 children. In a similar matching area, the MSG was not fortified. Prevalence surveys of vitamin A status were conducted in both areas, before and after vitamin A fortification, and results demonstrated a significant decrease in xerophthalmia and a mortality rate 45% lower in program villages compared to control villages. In a randomized clinical trial, mothers in the treatment group were given 400,000 IU of vitamin A in the two week post-partum period, and babies were given 100,000 IU of vitamin A when they were greater than 4 months of age. Mothers and babies in the control group did not receive vitamin A. Each group consisted of 1600 babies. Results showed a significant increase in breast milk vitamin A and serum vitamin A of the babies in the treated group. Mortality in the treated group was 29.1 per 1000 live births compared to 47.4 in the control group. Both studies demonstrated that vitamin A intervention plays a significant role in reducing preschool child and infant mortality.

EFFECT OF SINGLE DOSE VAC ON BREASTMILK AND MORBIDITY IN MOTHERS OF LOW SOCIO-ECONOMIC STATUS IN BANGLADESH, S. K. Roy[1], A. Islam[2], A Molla[2], Akramuzzaman[1].

[1]International Centre for Diarrhoeal Disease Research, Bangladesh.

[2]Aga Khan University Hospital, Karachi, Pakistan.

The role of Vitamin A deficiency for increasing morbidity in breast-fed infants is unknown. Since in developing countries infection and diarrhoea occur in breast-fed babies, a possible protective role of Vitamin A through breast-milk remains to be examined. A cohort of 50 women of low socio-economic status in peri-urban Dhaka, aged 16-35 years, were randomly given either 200,000 I.U. of Vitamin A or placebo at delivery. Morbidity data of mothers and infants on diarrhoea, fever, respiratory infections and other illnesses were recorded twice weekly for one year. Samples for Vitamin A and retinol binding protein (RBP) were obtained from breast-milk and blood at delivery, after 24 hours, 1 month, 3 months and 9 months. The results showed a high fluctuation of Vitamin A intake from food source during follow-up period. The serum and breast-milk Vitamin A levels rose significantly higher ($P < 0.001$) after supplementation and gradually dropped. The malnourished mothers maintained significantly higher level of Vitamin A in breast-milk up to 6 months and serum level up to 3 months. There was a significant difference ($P < .01$) in reduction of respiratory tract infection in the children of supplemented mothers. There was no significant difference in the incidence of diarrhoea in the mothers and in weight gain between the two groups of breast-fed children. The study suggests a positive impact of Vitamin A supplementation on breast-milk, especially amongst the malnourished mothers.

IMMUNE STATUS IN CHILDREN WITH MILD VITAMIN A DEFICIENCY, **Richard Semba, Muhilal*, Alan Scott**, Sopandi***, Gantira Natadisastra***, Keith West, and Alfred Sommer. ICEPO, Wilmer Institute, Johns Hopkins Hospital, Baltimore, MD, USA, *Nutrition Research and Development Centre, Ministry of Health, Bogor, Indonesia, **Dept. Immunology and Infectious Diseases, Johns Hopkins School of Hygiene and Public Health, Baltimore, MD, USA, ***Cicendo Eye Hospital, Bandung, Indonesia.**

A double-blind, randomized clinical trial was carried out with 236 clinically normal and vitamin A-deficient (XN and/or X1B) preschool children in Indonesia to determine the effect of mild vitamin A deficiency and vitamin A supplementation (200,000 IU, oral) on immune status. Children were age and sex matched into four groups. Clinically normal children and vitamin A-deficient children received either vitamin A or placebo. Two weeks following administration of vitamin A or placebo, children received oral polio, intranasal influenza, and intramuscular DPT vaccines to test the competence of mucosal, humoral, and cell-mediated immunity. Saliva, sera, lymphocytes, and serum vitamin A levels were obtained at the initial visit and at three weeks following immunization. Detailed anthropometry, and ophthalmological and pediatric exams were performed. Patient follow-up rate was 97%. Total sIgA, antigen-specific sIgA to polio and influenza, antigen-specific humoral Ig responses to DPT, lymphocyte blastogenesis to mitogen and DPT, natural killer activity, lymphokine expression, and T cell subsets are compared between the four groups and will be presented and discussed.

IMMUNE STATUS OF CHILDREN WITH MILD VITAMIN A DEFICIENCY.

P. Bhaskaram, S.A. Jyothi and K. Visweswara Rao (1987-88). National Institute of Nutrition, ICMR, Hyderabad, India.

Abstract: Recent studies carried out in Indonesian children suggest a causal relationship between mild vitamin A deficiency and infection, thus supporting the contention that vitamin A is an anti-infective vitamin. However, the mechanisms underlying this property are not clearly elucidated in humans. Therefore, comprehensive immunological studies were carried out in poor children having mild vitamin A deficiency denoted by serum retinol levels below 20 ug/dl. These studies indicated that the metabolic functions of neutrophils to produce bactericidal substances like hydrogen peroxide and superoxide, the specific antibody elaboration on challenge with diphtheria and tetanus toxoids, macrophage function in terms of cytotoxic capacity and interleukin-1 (IL_1) elaboration and the secretory IgA (SIG_A) content in saliva were found to be comparable between groups of children having serum retinol levels below or above 20 ug/dl. The T lymphocyte percentage was however significantly lower in children with deficiency though the ratio of T_4 (helper) to T_8 (suppressor/cytotoxic) cells and the response to *in vitro* mitogenic stimulation of the T cells was unaltered. These observations suggest that the immune responses, except T cell number are not significantly changed in children with milder degrees of vitamin A deficiency and thus do not offer a strong immunological basis for the increased susceptibility of these children to infection. Further, these observations are of public health importance in communities where vitamin A deficiency is widespread as they suggest that mild vitamin A deficiency is not a contraindication to mass vaccination programmes.

Vitamin A deficiency in acute access of Malaria in children

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We have realized in Popular Republic of Congo an investigation to establish the effect of some infectious or parasitical diseases on the vitamin A status. This study enrolled four hundred and fifty four children, from six months to six years old, from February to May 1988 in urban areas (Brazzaville and Pointe-Noire). The most interesting result concerns the Vitamin A deficiency in children with malarial access. Malaria, and to a lesser extent, vitamin A deficiency are responsible for a high morbidity and mortality in childhood (1).

We have isolated three groups of children:

- 49 in the course of a malarial access.
- 75 children with a past history of malarial accesses.
- 62 healthy children without a past history of malarial access but probably plamodium carriers in regard to the important prevalence of malaria in Congo.

The children's vitamin A status was assessed by two methods:

- First, the impression cytology with transfer (IOT) (2).

Presence of goblet cells and normal epithelial cells indicate a normal vitamin A status (normal). Absence of goblet cells and presence of enlarged epithelial cells indicate a peripheral vitamin deficiency (deficient). An intermediate cytological aspect indicates what we have termed a marginal vitamin A status. The significance of this latter group is not well known.

- Second, plasma retinol concentration less than 10 µg/100ml indicates vitamin A deficiency (3).

The results are shown in the table:

	healthy Children		Children with malarial access		Children with antecedents of malarial access	
IOT	%	(n)	%	(n)	%	(n)
Normal	48.3	(30)	44.9	(22)	57.3	(43)
Marginal	44.6	(28)	26.6	(13)	32.3	(24)
Deficient	6.5	(4)	* 28.6	(14)	10.7	(8)
Retinol (µg/100ml)						
Mean ± SD (n)	31.5 ± 14.3	(52)	† 14.8 ± 9.5	(48)	28.4 ± 14.8	(68)
retinol > 20		44		8		42
10 < retinol < 20		7		22		26
retinol < 10		1	37.5%	18		0

* : significant difference (x^2 test) compared to the 2 other groups, $p < 0,1\%$

† : significant difference (t test for $n > 30$, after variance analysis) compared to the 2 other groups, $p \ll 0,1\%$.

We found 28.6% and 37.5% deficient patients as assessed by IOT and a plasma retinol concentration under 10 µg/100ml, respectively. Plasma retinol concentration and IOT results during malarial access are significantly different from those of the other patients.

We conclude that there is a significant relation between vitamin A deficiency and malarial access (4) that can be responsible for an increased risk of morbidity and mortality from both conditions.

1. Sommer A, Tarwatjoi, Hussaini G, and al. Increased mortality in children with mild vitamin A deficiency. Lancet 1983, 2: 585-8.
2. Amédée-Manesme O, Luzeau R, Carlizr C, Ellroot A. Simple impression cytology method for detecting vitamin A deficiency. Lancet 1987, 8544,1: 1263.
3. Goodman DS. Vitamin A and retinoids in health and disease. New England J Med 1984, 310: 1023-31.

IMPACT OF ORAL VITAMIN A SUPPLEMENTATION ON THE MORBIDITY OF DIARRHOEAL AND ACUTE RESPIRATORY DISEASES IN BREAST-FED BANGLADESHI CHILDREN,

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Vitamin A was known, by earlier reports, to reduce morbidity and mortality of diarrhoeal and acute respiratory tract diseases in children. The objective of this study was to examine the impact of vitamin A supplementation on the morbidity due to diarrhoeal diseases and acute respiratory tract diseases in the breast-fed Bangladeshi children. 91 eligible children (median age 7 months, range 3-9 months) with normal nutritional status (age/wt approx. 80% of 50th percentile, National Centre of Health Statistics Standard) presenting with acute watery diarrhoea were selected randomly and allocated into 3 groups. Group I only the children received a single dose of vit A 200,000 units orally, group II both children and the mothers received the same dose of vit A 200,000 units orally, and group III did not receive any vit A supplementation (controls). The subjects were followed-up for 1 year. Serum vit A levels before vit A supplementation were 21.5 ± 1.4, 21.1 ± 2.0 and 20.7 ± 1.6 (µg/dl) in group I, II & III respectively. Similar results after 3 months of giving vit A were 34.2 ± 1.4, 32.9 ± 1.6 and 30.1 ± 1.9 (µg/dl) respectively and after 6 months 34.4 ± 1.9, 34.2 ± 2.2 and 33.7 ± 1.9 (µg/dl) respectively. The number of diarrhoeal episodes per child per year in the three groups were 4.1, 4.7 and 4.7 respectively, and number of acute respiratory tract infections per child per year were 5.2, 5.4 and 5.4 respectively. The differences in the serum vit A levels and in the morbidities of the diseases among the three groups were not significant. Rest of the data are in the process of analysis.

INVESTIGATION OF THE THERAPEUTIC EFFICACY OF VITIAMIN A FOR CHILDHOOD DIARRHOEA, Beth Henning, P.O. Box 1535 Kathmandu Nepal, Johns Hopkins School of Hygiene and Public Health, Dept of International Health, Division of Nutrition, Director of Primary Care SCF-USA in Nepal; Kathren Stewart, A.L. Alam, and J. Zaman,International Center of Diarrhoeal Research, Division of Community Medicine, Dhaka Bangladesh; Kenneth Brown, Johns Hopkins School of Hygiene and Public Health, Dept.of International Health, Division of Nutrition, 615 N. Wolfe Street, Baltimore MD.

The therapeutic efficacy of vitamin A supplementation for diarrhoea was investigated in this double-blind clinical trial. 84 hospitalized children with acute watery diarrhoea and no clinical signs of vitamin A deficiency, were randomized to recieve 200,000 I.U. of vitamin A or placebo at the International Center for Diarrhoeal Disease in Dhaka Bangladesh. No statistical difference in duration of illness, stool output, emesis volume and fever time were detected between the two groups. In this study, vitamin A had no therapeutic value for acute episodes of diarrhoea in children, nor was it found to exacerbate the illness. From a programatic point of view, these findings suggest there is no contraindication to providing vitamin A supplementation for children with diarrhoea.

A SURVEY ON THE PREVALENCE OF VITAMIN A DEFICIENCY IN CHILDREN OF THE SLUMS OF KARACHI

Ayesha Molla, Ph.D., Falak Naz Rahman, M.B.B.S., Mohammad Khurshid, M.B.B.S., D. Path., FRC Path, and Abdul Majid Molla, M.D., Ph.D.
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This is a preliminary study (supported by combined programme in paediatric gastroenterology and nutrition, Harvard Medical School, Boston, USA) to determine if vitamin A deficiency is a significant public health problem in the poor urban population of Karachi.

To date very few data is available on the rate of vitamin A deficiency diseases in the community. In total 500 children, aged 6-60 months, 250 each from two different communities located in two areas have been selected in a random fashion. To seek information regarding history of diarrhoea, respiratory disease and dietary intake pattern, two questionnaire forms were formulated. Different grades of eye changes will be noted and blood samples will be taken for vitamin A estimation. Above all, the study aims to seek biochemical, dietary and clinical evidences for vitamin A deficiency in poor areas of Karachi. The survey has recently been started and it is expected that the analysis will be completed by October-November 1989.

TRANSFER TECHNIQUE VERSUS THE NON TRANSFER TECHNIQUE FOR CONJUNCTIVAL IMPRESSION CYTOLOGY:

Dr O Amédée-Manesme. C Carlier.

The technique of transfer impression was described in this presentation. The filter paper (HAWP 304 FO Millipore) is applied by finger pressure only to the infero temporal quadrant of the two eyes for a few seconds. The cells are transferred to a slide by finger pressure. The sample on the slide is fixed and stained in the same bath. The results are classified in 4 groups as follows:

Goblet cells	Appearance of the epithelial cells	Stages	Results
present	numerous, small	Normal	negative
present	numerous, small > enlarged, separated	Marginal(+)	negative
absent	enlarged, separated > small, in masses	Marginal(-)	positive
absent	enlarged, separated	Deficient	positive

The positive stages were related to serum and liver vitamin A deficiency. Over 5000 CIC were obtained in 5 countries , mainly in children aged 2 to 6 years. In 1- 20%, no imprint was obtained particularly in very young children. The rate improved with experience. Inflammatory trachoma interfere with CIC results. Sensitivity and specificity of the test would depend upon the criteria selected.

It is possible to use CIC to define vitamin A deficiency as a public health problem (WHO classification). 10.8 % of the patients (with or without ophthalmologic diseases) classified as positive CIC is equivalent to 5% of the population with a plasma retinol concentration less than10µg/100 ml .

DISC APPLICATOR FOR ASSESSING VITAMIN A (VA) STATUS BY CONJUNCTIVAL IMPRESSION CYTOLOGY (CIC-A)

D.G. Keenum,[1] R.D. Semba,[1] Sopandi,[2] G. Natadisastra,[2] Muhilal,[3] K.P. West Jr.,[1] A. Sommer,[1] [1]ICEPO, Dana Center for Preventive Ophthalmology, Wilmer Institute, Johns Hopkins University, 600 N. Wolfe Street, Baltimore, MD 21205 USA, [2]Cicendo Eye Hospital, Bandung, Indonesia. [3]Nutrition Research Center, Ministry of Health, Bogor, Indonesia.

CIC-A has emerged as a new, simple, non-invasive method to assess VA status by applying a strip of filter paper to the conjunctiva. Limitations include: irregularities in size of the cut pieces of paper and variation in the pressure applied across its surface, resulting in differences in the area of contact with the conjunctiva; three to five seconds of contact time; and, multiple handling of the paper. Because of these problems, we have devised a vacuum pump applicator that applies a disc of paper of fixed area to the conjunctiva, reduces time required, diminishes variations in pressure, and eliminates any contact with the fingers. CIC-A methods (disc vs. strip) were compared in 118 cases of xerophthalmia and 118 non-xerophthalmic controls 3-6 years of age from rural communities in West Java. A disc of filter paper was applied to the infero-temporal conjunctiva of one eye and a strip of paper to the same location on the other eye. Both techniques agreed 67% of the time. Approximately 80% of the discordance (57/73) was due to discs showing a normal epithelium attributed to a more complete transfer of ocular surface cells. In addition, the quality of abnormal disc specimens was superior to abnormal strip specimens by defined histologic criteria. Better disc specimen quality can further improve specificity of CIC-A in diagnosing VA status. Correlation of CIC-A with a composite index of VA status (serum VA levels, clinical status and response to treatment) will be made.

USE OF THE IMPRESSION CYTOLOGY METHOD WITH TRANSFER DURING A PREVALENCE SURVEY ON VITAMIN A DEFICIENCY IN MALAWI IN 1988. INTEREST OF THE METHOD AND RELATIONS WITH MORBIDITY AND ENERGY-NUTRIENT MALNUTRITION.

ESCOUTE A.J., Nutrition Section, Ministry of Health, Box 30377, Lilongwe, Malawi, CHIRAMBO M.C., Ophtalmic Department, Kamuzu Central Hospital, Box 149, Lilongwe, Malawi, LUZEAU R., AMEDEE-MANESME O., Inserm U. 56, Hôpital de Bicêtre, 78 rue du Général-Leclerc, 94275 Bicêtre, France.

The impression cytology method with transfer has been used during a prevalence survey conducted in the districts of Salima and Dedza East in September 1988. The anthropometric indicators confirm high rates of chronic undernutrition among the children between 2 and 6 years of age. Preclinical vitamin A deficiency is also found very high.

The interest of the impression cytology method with transfer is reviewed in light of the last findings not only in the Malawi survey, but through other surveys conducted recently in developing countries with similar methodologies.

The relations of preclinical vitamin A deficiency, detected by the impression cytology method with transfer, with morbidity and energy-nutrient malnutrition are analysed.

VITAMIN A DEFICIENCY FIELD SCREENING BY CONJUNCTIVAL IMPRINT CYTOLOGY: A STUDY OF TECHNOLOGY TRANSFER, Evangeline Olivar-Santos, M.D., M.H.A., Researcher, and Ramonette Aquino, B.S. Biochem, Research Assistant, Institute of Ophthalmology, University of the Philippines, Manila, PGH Opd. Taft Avenue, Manila; Alfred Sommer, M.D. M.H. Sc., Director, and Keith West, Ph.D., International Center for Epidemiologic and Preventive Ophthalmology, Johns Hopkins University, Baltimore, Maryland.

Conjunctival Impression Cytology (CIC) was done on 1730 children who were either cases of xerophthalmia or controls. The procedure was found to have a very low sensitivity rate (25%) which, however, was better than that of serum vitamin A level determination (sensitivity 16%). The specificity, however, was high and almost the same as that of SVA which was 81%.

The present report is the first one on CIC studies in the Philippines. It discusses advantages as well as pitfalls of the procedure. It also shows that the technology is readily transferable thus making CIC a promising practical and comparatively reliable screening tool for the detection of vitamin A deficiency in study populations.

ASSESSMENT OF MARGINAL VITAMIN A DEFICIENCY IN THAI SCHOOL CHILDREN BY IMPRESSION CYTOLOGY, DARK ADAPTOMETRY AND SERUM RETINOL, Emorn Udomkesmalee, Somsri Charoenkiatkul, Chureeporn Chitchumroonchokchai and Sakorn Dhanamitta, Institute of Nutrition, Mahidol University at Salaya, Nakhon Pathom 73170, Thailand.

As part of a baseline survey for a new school lunch program in Nong Khai Province, Northeast Thailand 468 children 6-11 years of age were assessed for vitamin A and anthropometric status. All children were evaluated by conjunctival impression cytology (CIC-A) following ICEPO methods (1988) and dark adaptation time (DAT) by a portable dark adaptometer. Blood was drawn on a 50% systematic subsample for serum retinol determinations by HPLC. All children were weighed and measured by height.

The prevalence of marginal vitamin A deficiency by serum retinol (<20 ug/dl) was 39%, by DAT (>120 seconds) was 36% and by CIC-A was 16% to 39%, depending on the cut off criterion used for borderline specimens. CIC-A status, DAT and serum retinol levels corresponded with one another in a dose-response gradient. Mean serum retinol levels were 23, 21, 20 and 17 ($\pm$7, 1SD) ug/dl for decreasing stages of CIC-A (normal, borderline normal / abnormal and abnormal), respectively ($r = 0.23$, $p < .001$). CIC-A abnormal children exhibited, on average, a 20-second longer time period to dark adapt than their CIC-A normal peers (117$\pm$55 vs 137$\pm$83 seconds, respectively, $p < 0.05$). DAT varied inversely with serum retinol levels (151$\pm$76 for <10 ug/dl, 127$\pm$68 for 10-19 ug/dl and 116$\pm$55 for > 20 ug/dl). Vitamin A deficiency was associated with stunted growth most clearly apparent with abnormal CIC-A. Impression cytology and portable dark adaptometry can detect marginal vitamin A deficiency in association with apparent functional consequences in Thai school aged children.

CONJUNCTIVAL IMPRESSION CYTOLOGY: COMPARISON TO BIOCHEMICAL MEASURES

Chris Kjolhede, MD, MPH[1], Tony Sadjimin, MD, MPH, PhD[2], Michael Dibley, MBBS, MPH[1]

We assessed the vitamin A status of children aged 2 to 5 years in five contiguous villages in rural Central Java from February to March, 1989. Children with fever were excluded. Three methods of assessing vitamin A status were employed including conjunctival impression cytology (CIC), fasting serum retinol and the relative dose response (RDR) test. Comparisons of CIC to fasting serum retinol (n=170) and RDR (n=75) using several definitions of abnormal in the latter two methods revealed poor sensitivity. Mean serum retinol levels of CIC normal and abnormal groups were not different. Younger children are more difficult to assess by CIC.

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RAPID APPRAISAL OF COMMUNITY VITAMIN A STATUS THROUGH SCHOOL CHILDREN.

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Barbara Underwood - National Institute of Health, Bethesda, Maryland, U.S.A.
Tryson Ngalande - Zambia Flying Doctor Service, Ndola, Zambia.

Abstract

Five primary schools were randomly selected in Ndola, Zambia, which yielded a study population of 1254 pre and school age children who were evaluated using clinical ocular examination, Conjunctival Impression Cytology, a history of Night-blindness, biochemical Vitamin A status, the Relative Dose Response and the IVACG dietary criteria. Of a total of 232 children examined at Kansenshi primary school (high income area), 1(0.3%) child had a history of night-blindness and 1(0.3%) child had bitot's spots. Out of 398 children examined at Masala primary school (middle income area), 3(0.7%) children had a positive history of night-blindness, 2(0.5%) a positive dark-adaptation test and 10(2.4%) had bitot's spots. Of 309 children examined at Chibolele primary school (low income area), 6(2.0%) had a positive history of night-blindness and 4(1.2%) had bitot's spots. From the 146 children examined at Kabwata primary school (Ndola rural), 2(1.4%) had a history of night-blindness, 4(5.1%) had a positive dark-adaptation test and 5(3.4%) had bitot's spots. Likewise, of 79 children examined at Lumano primary school (Ndola rural), 4(5.1%) had a positive dark-adaptation test and 1(1.2%) had bitot's spots.

A total of 98 sub-sample children at Kansenshi primary school had baseline Vitamin A values determined out of which 3(3.1%) had values between 10-19ug/dl. Ninty sub-sample children at Masala primary school revealed that 1(1.1%) had a Vitamin A value below 10ug/dl while 6(6.7%) had values between 10-19ug/dl. At Chibolele primary school, of the 110 sub-sample children, 22(20.0%) had baseline Vitamin A values between 10-19ug/dl while the rest had values above 20ug/dl. Likewise, of the 37 sub-sample children at Kabwata primary school, 10(27.0%) had baseline Vitamin A values between 10-19ug/dl. Of 18 sub-sample children

at Lwnano primary school, 6(33,3%) had baseline serum Vitamin A values between 10-19ug/dl.

It is concluded that clinical signs of Vitamin A deficiency are a public health problem in Chibolele and Ndola rural schools. Using the P.A.H.O criteria that if 15% of surveyed children have serum Vitamin A levels between 10-19ug/dl, this represents a significant public health problem, then Chibolele and Ndola rural schools have a significant public health problem. The presentation will outline the sensitivity and specificity of clinical ocular examination, the usefulness of a hist y of night-blindness, dark-adaptation, Conjunctival Impression Cytology, the IVACG dietary Criteria and Relative Dose Response in assessing communities at risk of developing Vitamin A deficiency/xerophthalmia.

BIOCHEMICAL ASSESSMENT OF VITAMIN A DEFICIENCY, H Flores, FACS Campos, MCNA Azevedo, MHC Barreto-Lins, SRMC Albuquerque, MBM Silva, AC Salzano, RM Varela, MAG Lapa, Department of Nutrition, Federal University of Pernambuco, Recife, PE 50.739, Brazil, and BA Underwood, National Eye Institute, National Institutes of Health, Room 6A-08, Bethesda, MD 20891, USA.

Serum retinol levels are one of the most used - but least credited - indicators of vitamin A deficiency. The interpretation of the values is generally difficult and controversial. Yet, the advent of a new method to assess "true" vitamin A deficiency, the Relative Dose Response (RDR), has made possible to refer other indicators to this "reference index". Data collected from around 2,000 children from slum areas and country cities in Pernambuco have permitted to correlate serum retinol levels, the RDR and the 30 d response of serum levels to a massive dose of vitamin A (S30DR). Also, sera collected 30-45 d after a massive dose of vitamin A from children participating in a universal vitamin A distribution program in Caruaru have permitted to define a frequency distribution curve for individuals known not to be vitamin A-deficient. High and highly significant correlation coefficients were found for the regressions of RDR and the S30DR on basal serum retinol levels, and of the S30DR on RDR. The *x* intercepts for the regression curve of the former were 49.8 and 52.8 µg retinol/dl, respectively. The regression coefficient for the latter was close to 1 (0.874). This suggests that these three indicators can be used for assessment of populations. The shape of the frequency distribution of serum retinol levels for 724 children, after a massive dose of vitamin A, was very close to that of a normal distribution, with a mean of 50.7 µg retinol/dl, and 30.6, 48.4 and 82.8 µg/dl for percentiles 2.5, 50 and 97.5. When related to RDR, serum retinol values below 30 µg/dl presented with high sensitivity (86.4%), specificity (97.6%), positive (96.1%) and negative (91.3%) predictive values. As regards the distribution of serum retinol levels, positive (≥20%) and negative (<20%) RDR separated two distinctly defined groups.

FINANCIAL SUPPORT: grants RHA-BR-3-85-49 (NAS/AID), 40.0039 (CNPq, Brazil) and Project Hope (Fortaleza, Brazil).

NEW METHODS FOR THE ASSESSMENT OF VITAMIN A STATUS,

James Allen Olson, Harold C. Furr, and Sherry Tanumihardjo, Dept. of Biochemistry and Biophysics, Iowa State University, Ames, IA 50011, U.S.A.

Current methods for assessing marginal status include the relative dose response (RDR), developed by Underwood, and conjunctival impression cytology (CIC), developed by Sommer, Hatchell, and Natadisastra. New procedures developed in our laboratory are the modified relative dose response (MRDR) and isotope dilution analysis (IDA). In the MRDR, a single blood sample is taken 5 h after the administration of a dose (100 ug/kg BW) of 3,4-didehydroretinol (DHR)). The ratio of DHR to retinol (ROL) in the serum is inversely proportional to the liver reserves of vitamin A up to approximately 20 ug/g liver. This procedure has been applied to healthy preschool age children in the United States and Indonesia and to undernourished children in Indonesia. A tentative cutoff value of 0.03 is suggested for the ratio of DHR to ROL in children with an adequate vitamin A status. After a dose (45 mg) of deuterated vitamin A is given orally to healthy adults, the deuterated analog equilibrates with endogenous reserves of vitamin A during a 20 hour period. Thereafter, the ratio of deuterated to nondeuterated vitamin A in the blood is inversely proportional to the total body reserves of the individual. This method has been validated by measuring the vitamin A levels in liver biopsy samples obtained from the same persons. These two procedures should be helpful in evaluating the relationship between morbidity and mortality on the one hand with vitamin A reserves on the other. Supported by USDA-CRG-87-CRCR-1-2320, NIH-DK-32793, NIH-CA-46406 & Thrasher Research Fund 2800-8.

TOLERANCE OF PRESCHOOLERS TO TWO DOSAGE STRENGTHS OF VITAMIN A PREPARATION, Rodolfo F. Florentino, Celeste C. Tanchoco, Adelisa C. Ramos, Teresa S. Mendoza, Erlinda P. Natividad, and Juamina Belen M. Tangco, Food and Nutrition Research Institute, Department of Science and Technology and Nutrition Service, Department of Health, Manila, Philippines.

The tolerance to two dosage strengths of vitamin A preparation by age, sex and nutritional status was determined in a double-blind study involving 2471 children aged one to six years old in Pililla and Binangonan, Rizal. Each child 1-6 years of age not suffering from active xerophthalmia or from nausea/vomiting, headache, diarrhea and fever was randomly given 1 ml of syrupy suspension later identified to contain 200,000 IU, 100,000 IU of vitamin A or placebo dose. Clinical evaluation of subjects was done by physicians after 24 hours and one week of dosing.

Nausea/vomiting and headache were clear manifestations of intolerance. Nausea/vomiting occurred in 8.8% of children given 200,000 IU and 100,000 IU of vitamin A, respectively, while headache was complained of in 5.9% and 2.0%, respectively. Of these children, almost all experienced the symptoms within 24-hours after dosing, lasting for no more than 12 to 24 hours. The incidences of diarrhea and fever, though slightly elevated, were not significantly different from the placebo. Nausea/vomiting, diarrhea and fever were most common among the one to two year olds. There was a consistent trend towards increasing occurrence of symptoms with deteriorating level of nutritional status especially in the high and medium dose groups. The severity of diarrhea ranged from mild to moderate only, while severe episodes of vomiting were very minimal (1.2%) and solely demonstrated by those given the high dose vitamin A. About 7.9% of those in the placebo group complained of at least one symptom within 24 hours after dosing due to the current community incidence of illness and/or to placebo effect (estimated at about 3%). Nevertheless, almost all (89%) of the study population irrespective of treatment group reported positive reactions to the intake of the preparations given.

UNDER WHAT CONDITIONS ARE VITAMIN A DEFICIENCY CONTROL PROGRAMS COMPETITIVE WITH OTHER CHILD SURVIVAL STRATEGIES?, Robert Tilden, Department of Population and International Health, School of Public Health, The University of Michigan, 109 Observatory, Ann Arbor, Michigan 48109.

A comparison will be made of the level of health benefits produced by vitamin A interventions under varying levels of mortality reduction, with different child survival strategies such as immunization, MCH services, ORT promotion, and basic improvements of health centers in West Java, Indonesia. The mortality reduction levels estimated by Muhilal in West Java, and Sommer in Aceh (35%) will be used as the optimistic figures in the initial comparison. This will be reduced to several lower mortality reduction levels (20%, 10%, 5%, 2.5%, 1%), holding cost constant, so as to explore for a threshold level of mortality reduction, below which vitamin A deficiency control is no longer the most preferred approach to improve health status. The cost-effectiveness model developed by Grosse and Tilden at the University of Michigan School of Public Health will be used for the projections.

CONTROL OF VITAMIN A DEFICIENCY AND XERÓPHTHALMIA IN VIET NAM. Tu Giay, Ha Huy Khoi (National Institute of Nutrition). Nguyen Trong Nhan (National Institute of Ophthalmology). Jean M. Dricot (UNICEF, Hanoi, Viet Nam).

During 1985-1988, epidemiological surveys on vitamin A deficiency and xerophthalmia have been carried out by the National Institute of Nutrition and the National Institute of Ophthalmology on 23,782 preschool children in 13 provinces of different ecological regions of the whole country. The results of these surveys supported by UNICEF have shown the public health significance of the problem.

Classification	Number of cases	Prevalence %	WHO's criteria of PH significance
Night Blindness XN	84	0.35	>1%
Bitot's Spot XB	36	0.15	>0.5%
Corneal Xerosis X2	13	0.06	>0.01%
Keratomalacia X3A-X3B	6	0.02	
Corneal Scar XS	30	0.13	
Total	169	0.71	

National programme for control of vitamin A deficiency has been established with UNICEF's support. The strategy of the programme is:

1. Health personnel development on programme management, ocular signs, diagnosis, treatment schedules and rich-carotene food preparation.

2. Social mobilization activities principally targeted on mothers group.

3. Universal distribution of high dose vitamin A capsules for children aged 6-36 months and for lactating women in combination with GM/P programme and with participation of Health and Education Ministries, and Red Cross Association.

4. Targeted distribution for at risk children in hospitals.

5. Implementation of household food gardens, focussing on carotene-rich food, and legumes production in the framework of the Household Food Security Project (UNICEF VAC project).

6. Monitoring of vitamin A distribution and evaluation of the xerophthalmia signs prevalence before and after the campaign.

In 1988, the main activities have been the training of 450 national and provincial health cadres and 800 district and commune health workers, the distribution of 7,000 posters and 5,000 booklets, the delivery of 350,000 vitamin A capsules in mass campaign distribution, the supply of vitamin A capsules at 87 hospitals.

About 7 tons of local seeds (carrots, amaranth, pumpkins, beans, peas, soybeans, peanuts) have been distributed to cooperatives and families for food production and self consumption. In 1989, the first activities evaluation data are expected as well as acceleration of the vitamin A distribution.

EVALUATION OF THE IVACG GUIDELINES TO THE DEVELOPMENT OF A SIMPLIFIED DIETARY ASSESSMENT TO IDENTIFY GROUPS AT RISK OF INADEQUATE INTAKE OF VITAMIN A, Mohammad Abdullah & Luthfor Ahmed, Institute of Nutrition and Food Science, University of Dhaka, Dhaka-1000, Bangladesh.

With a view to evaluating the extent to which the IVACG proposed simplified method can predict the dietary vitamin A intake of pre-school children, an indepth study was conducted in Bangladesh. The study included two different locations in terms of difference in the prevalence of xerophthalmia and two different seasons with regard to the availability of carotene-rich foods. A weighed survey of household dietary intake for three consecutive days was conducted in 112 households. Individual intakes of 2-5 year old children in the survey households were also measured. Each day of the weighed survey was followed by a 24 hour recall survey by the simplified method developed according to IVACG Guidelines. Vitamin A and corotene-rich foods consumed by the child, as assessed by the weighed survey, were converted into equivalents of small servings for comparison with the same estimated by the simplified recall method.

There was a very good agreement between the consumption index (CI) scores obtained from the weighed intake survey and the simplified recall method. Matched paired test did not show any difference between the CI scores obtained by the two methods. The study revealed that the simplified method can fairly predict the vitamin A and carotene-rich food intake of pre-school children and the method can be regarded as a useful tool to identify groups of children "at risk" of inadequate vitamin A intake.

Day to day variations in the intake of vitamin A and carotene-rich foods were large but the seasonality in 24 hours intake was not very marked. Seasonal variations in the habitual intake pattern were, however, large indicating the usefulness of supplementing 24 hours intake estimates by information on usual consumption pattern, in different seasons.

Home Garden as a Practical Measure to Combat Vitamin A Deficiency

(An abstract of report to be presented at 1989 AVACG meeting)

Y. H. Yang
Coordinator
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Vitamin A deficiency in one of the leading nutrition problems in the developing countries particulary in rural areas of Asia and Africa. Its long term solution would depend on the increased consumption of foods rich in vitamin A value. Dark green leafy vegetables are very rich in vitamin A value as well as in protein (on dry basis), calcium, iron, riboflavin, and ascorbic acid, the nutrients commonly deficiency in people with vitamin A deficiency. Home garden, therefore, is of special value to rural people in the third world.

Records kept in Hawaii confirmed the value of home garden. A well managed (no insecticide application), mixed garden of only 200 sq feet(18 square meters), with sequential cropping of highly nutritious vegetables can supply a family of 5 persons in term of theirRDA: energy 2 %, protein-10 %, iron-27 %, calcium-35 %, vitamin A value-219 %, and ascorbic acid-198 %.

Experiences of home garden programs in Taiwan, Guatemala, Philippines, Republic of Korea, Jamaica, and recently the mainland China crystallized an innovative approach to home garden specially appropriate to the humid tropical area. Perennial crops including malunggay, edible hibiscus, and sesbania grandflora will be planted along with annual crop. Soil fertility and moisture conservation will be achieved through recycling of organic materials, deep-digging, mulching, contouring, and green manuring. Training at different levels in horticulture, nutrition, as well as methods of program planning and evaluation should be thoroughly conducted.

A "Seeds for Peace" aimed at combaing vitamin A deficiency of people through organized home garden program will be introduced. Better utilization of available resources including efficient coordination among institutes and organizations in promoting home garden program will be suggested.

January 28, 1989

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DETECTION OF VITAMIN A DEFICIENCY BY OCULAR IMFRESSION CYTOLOGY

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Effective intervention requires a simple technique for identifying communities in which Vitamin A deficiency is prevalent. The principle of Ocular Impression Cytology is to look for mucus secreting cells by a staining procedure on an impression made from the bulbar conjunctiva on cellulose acetate filter paper. The technique was applied to 108 children for the first time in Bangladesh. A simple two-step staining procedure of the cells transferred to a glass slide was employed. It gave a sensitivity of 88 % and specificity of 71 % taking the presence of goblet cells and or mucin spots in any eye as the criterion for normal Vitamin A status. With the presence of goblet cells alone as the indicator of normal Vitamin A status, the sensitivity and specificity were 90 % and 45 % respectively. Children so identified as having a normal or deficient Vitamin A status by Impression Cytology could also be differentiated by serum retinol. Impression Cytology can be applied for identifying communities at high risk of xerophthalmia.

BETA-CAROTENE LOSS AFTER DIFFERENT METHODS OF COOKING OF GREEN LEAFY VEGETABLES EATEN BY PEOPLE OF BANGLADESH

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ABSTRACT

Green leafy vegetables containing beta-carotene (provitamin A) may serve as an alternative inexpensive source of vitamin A for the majority of the poor people in developing countries. Previos a few studies showed conflicting results as to whether or not considerable amounts of beta-carotene in vegetables are destroyed considerably by cooking. The present study was, performed to assess the extent of beta-carotene loss in vegetables subjected to three traditional methods of cooking practised in Bangladesh: Method I: boiling for 7-9 min followed by frying in oil for 4-6 min in open pot with stirring and allowing the water portion to evaporate or to be thrown away. Method II: simple boiling for 8-10 min with the lid of the pot on for most of the cooking time. Method III: placing vegetable on the surface of partially cooked rice until cooking is done and then mashing it into a paste with condiments. Housewife volunteers (8-10) participated in the cooking experiments using each of 6 types of commonly eaten vegetables; only one type was used in Method III. A modified Holden's method which was used to measure beta-carotene was statistically comparable to the conventional method of the AOAC (1984). The % loss of beta-carotene Method I, 31 to 43%; Method II, 11 to 14%; Method III, 2.3 to 11%. The beta-carotene contents of 14 types of commonly eaten green leafy vegetables in Bangladesh ranged between 5400 µg and 16000 µg per 100 g. The cause and implication of the high loss of beta-carotene by cooking Method I are discussed. Health planners of developing countries should educate people to use cooking methods similar to the Methods II and III.

FAMILY FOOD PRODUCTION AS A NUTRITION INTERVENTION STRATEGY: SOME LESSONS FROM THE PACIFIC ISLANDS, Paul Sommers, UNICEF, Suva, Fiji.

The poster display provides an overview of the UNICEF Pacific Region Family Food Production and Nutrition Project. It features a successful model in community assessment and action in how to improve household food availability through production and consumption of home grown foods. The project strategy has important implications for programmes promoting a dietary solution to vitamin A deficiency.

VITAMIN A AND PROTEINS IN TEAR FLUID, Eric J. van Agtmaal[1], Martin W. Bloem[2], Andries J. Speek[2], Sastri Saowakontha[3], Nicolaas J. van Haeringen[1] en Wil H.P. Schreurs[2]. [1]: Netherlands Ophthalmic Research Institute (Amsterdam, The Netherlands), [2]: TNO-CIVO Toxicology and Nutrition Institute (Zeist, The Netherlands), [3]: Khon Kaen University (Khon Kaen, Thailand).

As part of the "Thai-Netherlands Nutrition Supplement Co-operation Project" the effect of a single, oral dose of retinylpalmitate (110 mg) was investigated on levels of retinol, lysozyme, lactoferrin, S-IgA, amylase, N-acetyl-neuraminic acid and total protein in tear fluid of marginally nourished preschool children in the Sakhon Nakhon Province, Northeast Thailand.

For the purpose of this experimental study two techniques were designed and applied: tear fluid was collected using cellulose sponges and retinol was determined fluorometrically using high performance liquid chromatography.

Two months after supplementation of relinylpalmitate a significant rise of tear fluid retinol levels in the supplemented group was observed as compared to the non-supplemented group, while after four months no difference could be found. Besides to supplementation of vitamin A, tear fluid retinol levels are related to age, because the levels of normal Dutch adults were found to be considerably higher than the levels of normal Dutch preschool children.

The supplementation with vitamin A did not significantly affect levels of the various proteins in tear fluid of the Thai children after two and four months.

THAILAND COUNTRY REPORT, S. Dhanamitta, T. Viriyapanich, E. Udomkesmalee, S. Smitasiri and Y. Kachondham, Institute of Nutrition, Mahidol University, Nakorn Chaisri, Nakorn Pathom, Thailand

Presently Thailand does not have a national vitamin A program. Since a nation wide ocular survey has not been conducted, the vitamin A deficiency problem was considered to be relatively less in importance in relation to Protein Energy Malnutrition, Iron Deficiency Anemia, and Iodine Deficiency Disease.

Information on the magnitude of the vitamin A deficiency problem and its geographic distribution in the country was obtained on accumulation of small scaled surveys and research studies as follows. 1.) Xerophthalmia and serum retinol of the deficiency level existed during the early 60's to the mid 70's especially in the North and Northeastern Thailand, 2.) During the mid 80's vitamin A deficiency has declined to marginal levels. It appears that vitamin A deficiency in the country, at present, is marginal rather than severe, and 3.) Nevertheless sporadic cases of clinical manifestations and deficient serum retinol levels in preschool children can still be found in some specific areas in the rural Northeastern communities.

The local vitamin A program can be classified into two categories: 1.) Survey the prevalence of xerophthalmia and degrees of inadequate vitamin A status in the high risk areas (North and Northeastern Thailand) both in dry and rainy seasons and 2.) Research models for vitamin A intervention strategy. Two ongoing research projects were conducted in the Northeastern region - Social Marketing of Vitamin A Rich Foods Project which employs nutrition education alone, and an Integrated Nutrition Program which employs agricultural activities, school lunch activities, and communication motivation activities in the targeted primary school children.

Vitamin A Programs in Brazil

H Flores. Department of Nutrition, Federal University of Pernambuco, Recife, PE 50.739, Brazil.

Several programs currently under way aim to the eradication of vitamin A deficiency, directly or indirectly, with national or regional coverage. The main problem to affect virtually all these Programs is continuity.

1) The National Institute of Foods and Nutrition (INAN) coordinates a program of distribution of massive doses of vitamin A in 8 states of Northeast Brazil. When vitamin A supplements are distributed, they reach the target population through the national polio immunization campaigns. However, the periodicity of these distributions is not regular.

2) Several Food Supplementation Program are in effect since 1980-1981. They are aimed at the distribution - or sale at reduced prices - of "basic foodstuffs" (beans, rice, powdered milk, corn, oil, spaghetti, sugar and meat) to low income families. Whole milk is seldom available, and when skimmed milk is used, this is rarely enriched with vitamin A. The coverage depends on the availability of funds, which is irregular and scarce. A special Milk Program started in 1985, and operates nation wide since 1987. In 1988, 3.8 million children had access to the program, a number expected to increase to 10 million in 1989. It has been observed that milk is "diluted" in the whole family in 60% of the cases. Only families with an income below 2 minimum wages (approximately 800 dollars per year) benefit from this program.

3) Since 1981, INAN promotes programs to incentive breast feeding. An evaluation conducted in 1987 suggests that the breast feeding period increased from 89 to 129 days.

4) A program to stimulate agricultural activities with emphasis in the production of foods rich in energy, protein, iron and vitamin A is in effect in 8 states of the Northeast and 4 of the South. No evaluation has been carried out yet.

In short, nine government programs operated by 6 different ministries, with a target population of 45 million people, are operating with different degrees of efficiency (mostly low).

One state and one municipal program of supplements distribution, in Paraíba and Caruaru (Pernambuco) have suffered less interruptions. The Paraíba program was found to decrease the prevalence of XN (from 0.1 to 0.04%) and XS (from 0.07 to 0%) between 1981 and 1983. The Caruaru program seems to have created sufficient internal demand to guarantee continuity without outside help.

It is generally agreed that vitamin A deficiency is a problem of public health magnitude in the Northeast, and there is much evidence that it may be endemic in some areas of the south of the country as well. However, no "national surveys" have been conducted.

Data from the Caruaru Vitamin A Program are suggestive that vitamin A deficiency might be a major, underlying health problem of deprived children.

The vitamin A-specific programs mentioned above are nearly all vertical and centralized. The exception is the community-based Caruaru program.

Vitamin A Status Survey of Myanmar Children

Moe-Moe-Sunn, Thane-Toe and Khin-Maung-Naing,Nutrition Research Division, Department of Medical Research.

Abstract

Field surveys including eye and physical examination together with collection of blood samples were conducted in 1015 children aged 2-14 years from randomly selected villages in Monywa, Kyaukpadaung and Taunggyi townships. Eye lesions such as conjunctival xerosis with Bitot's spots (X1B Xerophthalmia) which is regarded as indicative of chronic vitamin A deficiency was found to be prevalent in Monywa and Kyaukpadaung areas. Using trifluroacetic acid reaction, deficient serum vitamin A level (< 10 μg/dl) among 2-14 years old children was found 4.7% in Monywa, 8.9% in Kyaukpadaung and none in Taunggyi area. Low serum vitamin A level (10-19 μg/dl) was found 11.1% in Monywa, 51.1% in Kyaukpadaung and 6.7% in Taunggyi. Thus a clearer evidence of the magnitude of problem of vitamin A deficiency has been obtained in dry zone area of upper Myanmar.

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE (IDRC), OTTAWA, CANADA, Ms. Jenny Cervinskas, Programme Officer, Health Sciences Division.

The International Development Research Centre (IDRC) was created in 1970 by an act of the Canadian Parliament to provide funds and expert advice for development-related research in Third World countries. IDRC's mission is to contribute to economic and social development through research and activities that support research. It emphasizes applied research directly relevant to basic human needs and all activities are aimed at supporting a development process based on sustainable growth, equity, and participation. IDRC also aims to strengthen the research capacity and capabilities of developing countries. Therefore, almost all IDRC-supported projects are identified, designed, and carried out by developing country researchers. This approach helps ensure that problems of priority to the developing world are addressed and that the research results are accepted and used. IDRC has its headquarters in Ottawa, with six regional offices: one in each of Singapore, New Delhi, Nairobi, Dakar, Cairo and Montevideo. The total staff size numbers over 600 people. To fulfill its mandate most effectively, IDRC is organized to cover expertise in seven distinct fields: Health Sciences (HS); Social Sciences (SS); Agriculture, Food and Nutrition Sciences (AFNS), Communications, Earth and Engineering Sciences; Fellowships and Awards; and Information Sciences. There are also two extra-divisional units: The WID Unit and the Nutrition Unit (which was officially established only in January, 1989).

Some of the general characteristics sought in research proposals in nutrition are as follows: the research should: a) be oriented towards the application of existing knowledge for the solution of concrete problems (i.e. be action-oriented); b) be based on a recognition and analysis of the multiple causes of malnutrition; c) promote multi-disciplinary approaches to the investigation of food and nutrition problems, and involve a corresponding range of appropriate technical expertise and research methods; and d) be community-based and involve community members in the research process, where appropriate.A listing of research supported by IDRC on the topic of Vitamin A is available upon request.

VITAMIN A DEFICIENCY IN MICRONESIA: MAGNITUDE AND RISK FACTORS,

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A recent preliminary study in Truk indicated that over half of children presenting to an outpatient clinic had marginal vitamin A deficiency by conjunctival impression cytology and more than 10% had xerophthalmia (nightblindness and Bitot's spots). Vitamin A deficient children were at higher risk of middle ear infection and were more likely to be anemic. These findings have been extended by carrying out a population based vitamin A deficiency survey among preschool children throughout Truk state. Preliminary findings suggest 30% of children in the community have marginal vitamin A deficiency (by CIC-A) and nearly 5% have Bitot's spots. Further analyses of risk factors will be carried out and presented. This survey establishes vitamin A deficiency as an important public health problem for the first time in Micronesia.

Vitamin A delivery through an inhalative route.

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Vitamin A is delivered to the target tissues after release from liver stores as a complex of retinol bound to retinol binding protein (RBP). Consequently RBP is responsible for the delivery of retinol to the extrahepatic target tissues. It is assumed that this delivery process depends on cell surface receptors for RBP. If however, RBP synthesis is impaired as it is the case in liver diseases or the synthesis of RBP is decreased due to protein deficiency with an inadequate supply of substrate for RBP-synthesis, an extrahepatic vitamin A deficiency may develop. In this cases the supply of Vitamin A through an enteral route is not sufficient to fullfil the demand of extrahepatic tissues, because newly absorbed retinyl esters are largely taken up from the circulation by the liver and stored there. From this storage sites vitamin A is mobilized only when bound to RBP. To overcome the problem of vitamin A supply during impaired RBP synthesis we studied distribution, uptake and metabolism of free (not chylomcicron incorporated) retinylesters after intravenous adminsitration. We were able to show that these retinyl esters were taken up by extrahepatic tissues (tracheal mucosa, lung, testicle), after bypassing the liver, without any demand of membrane receptors or binding proteins. In the tissues the retinyl esters were rapidly hydrolysed and partly reesterified, depending on the demand of the tissues. Because free retinyl esters are only available after high oral doses (> 50.000 I.E.) we studied, whether an inhalative application of retinyl esters will increase the plasma concentration of these retinyl esters. After inhalation of 10.000 I.E. by means of an Aerosol in human volunteers, the plasma retinyl ester concentration was 35µg/dl after 5 Minutes. This inhalative route has two different advantges: The most sensitive target tissue, the lung is reached first, and an adequate protein synthesis is not necessary to fullfil the vitamin A demand of extrahepatic tissues.

RICE POWDER ORAL REHYDRATION SOLUTION (ORS) AND FOOD FOR CHILDREN WITH DIARRHOEA, M.E. Krantz, United Mission to Nepal, Kathmandu, Nepal.

In locations where sugar is not available, rice powder can be used in its place for making ORS.

The method for making rice powder ORS is as follows:

1.) Grind rice kernels into a fine powder. 2.) Measure 30 gm rice powder (one fistful) into a cooking pot. 3.) Add 2.6 gm salt (one three-finger pinch, wiped). 4.) Measure out 1/2 litre water (three level tea glasses). 5.) Mix a small amount of water with the rice powder and salt until well blended. Add the rest of the water. 6.) Cook the mixture until it has the appearance of rice water. 7.) Cool until it is ready to drink.

This ORS in addition to rehydrating, nourishes (energy, CHO, protein, B vitamins, minerals), tastes good, is culturally acceptable and can be made at home at low or no cost.

Feeding of children with diarrhoea. Children with diarrhoea need food as well as ORS. This is especially true of the many who are undernourished as well. Breast milk when available is excellent. Also the rice powder solution (or rice water) can be given for both rehydration and nourishment. For infants and children six months and older, a soft porridge made from "super flour" (sarbottam pitho) given in addition to the home-made ORS provides nourishment including helpful amounts of potassium. Pureed green leaves can be added while cooking the ORS or the porridge for valuable pro-vitamin A. Semi-solids and solids should be started gradually. Normal diet may be resumed as soon as stools return to normal, keeping the roughage content low for a few days.

SIGHT AND LIFE

PREVENTION AND ERADICATION OF XEROPHTHALMIA

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The SIGHT AND LIFE Task Force was founded early 1986 at ROCHE headquarters in Basle; its brief is to provide aid selectively to help to combat severe vitamin A deficiency.

The Management of ROCHE was of the opinion that ROCHE know-how and the contacts of many year's standing with leading international and private organizations such as the WHO, UNICEF, Helen Keller International, the International Eye Foundation, ICEPO, etc., would enable ROCHE to make an effective contribution to eliminating this urgent, worldwide health problem. Moreover, the Task Force is expected to help research into the complex interrelationships between nutrition and childhood morbidity and mortality.

Right from the start it was obvious that the Task Force should employ the funds to promote suitable existing projects supported by the authorities rather than creating its own parallel programmes.

The commitment of Roche covers three areas:
- scientific and technical support
- donations of free vitamin A in emergency situations
- financial contributions to research, development and training projects.

Within the framework of its budget, the Task Force can freely employ its funds on priorities it has chosen, taking into account the following guiding principles:

1. The Task Force is active only in countries in which xerophthalmia has been identified as a public health problem, according to WHO criteria;
2. The projects selected for support must be backed by the local health authorities;
3. The infrastructure necessary for careful and proper implementation of the project must be available.

Major activities supported by SIGHT AND LIFE have been:
- vitamin A intervention programmes (capsules, liquid vitamin A plus dispensers, food fortification);
- efforts to assess and monitor the vitamin A status of children;
- financial support of selected research projects;
- training support in case detection, treatment and prevention of xerophthalmia.

Public relations work is in many respects important for the success of the worldwide campaign against xerophthalmia, both in the Third World and elsewhere.

Since its foundation, the Task Force has endeavoured to engage in objective public relations. We have created various information tools, such as an exhibition wall, a bulletin, a slide show and a video clip. The exhibition wall gave rise to an illustrated brochure, which deals with the topic of the exhibition in greater detail.

At the beginning of the second three-year term, the Task Force feels that the aims and operational methods have proven to be right, particularly the mixture of emergency aid and technical and financial support.

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The following monographs are published by the International Vitamin A Consultative Group:

- *Guidelines for the Eradication of Vitamin A Deficiency and Xerophthalmia* (1977)
- *Recent Advances in the Metabolism and Function of Vitamin A and Their Relationship to Applied Nutrition* (1979)
- *The Safe Use of Vitamin A* (1980)
- *The Symptoms and Signs of Vitamin A Deficiency and Their Relationship to Applied Nutrition* (1981)
- *Biochemical Methodology for the Assessment of Vitamin A Status* (1982)
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- *Biochemical Methodology for the Assessment of Carotenes* (1987)
- *A Decade of Achievement: The International Vitamin A Consultative Group (IVACG) 1975-1985* (1987)
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- *Vitamin A Supplements: A Guide to Their Use in the Treatment and Prevention of Vitamin A Deficiency and Xerophthalmia* (published by the World Health Organization in conjunction with IVACG and UNICEF, 1988)
- *Guidelines for the Development of a Simplified Dietary Assessment to Identify Groups at Risk for Inadequate Intake of Vitamin A* (1989)
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DL PRINTING/543-2082